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FINAL REMEDIAL ACTION/NON-TIME CRITICAL REMOVAL ACTION WORK PLAN, SITE 12 (PUBLIC DOCUMENT)

09/01/2018
GILBANE FEDERAL

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Naval Facilities Engineering Command Southwest
BRAC PMO West
San Diego, CA

FINAL
REMEDIAL ACTION/NON-TIME CRITICAL REMOVAL ACTION WORK PLAN

Installation Restoration Site 12

Report and Exhibits 1 and 2, Figures, Appendix A through H

Former Naval Station Treasure Island, San Francisco, CA

September 2018

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Former Naval Station Treasure Island, San Francisco, CA

September 2018

Prepared for:

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Naval Facilities Engineering Command Southwest
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Naval Facilities Engineering Command Southwest
BRAC PMO West
San Diego, CA

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This Work Plan was prepared in accordance with currently accepted professional practices and under the direct supervision of the Project Manager and the Professional Geologist registered with the State of California, whose signatures appear below.

Arvind Acharya (PG#6097) 4/9/2019

Arvind Acharya — Date
Program Manager, P.G.

____________________ ____________________

John Baur — Date
Project Manager

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TABLE OF CONTENTS

LIST OF EXHIBITS

LIST OF FIGURES

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

ºF	degrees Fahrenheit
µg/kg	micrograms per kilogram
2,3,7,8-TCDD TEQ	2,3,7,8- tetrachlorodibenzo-p-dioxin toxicity equivalent
4,4-DDD	4,4-dichlorodiphenyldichloroethane
ACM	asbestos-containing material(s)
AHA	activity hazard analysis
alpha-BHC	alpha-benzene hexachloride
ANL	Argonne National Laboratory
APP	Accident Prevention Plan
BAAQMD	Bay Area Air Quality Management District
BaP EQ	benzo(a)pyrene equivalents
BCT	Base Closure Team
bgs	below ground surface
BMPs	best management practices
BRAC	Base Realignment and Closure
CB&I	CB&I Federal Services, LLC
CCSF	City and County of San Francisco
CDPH	California Department of Public Health
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COCs	chemicals of concern
CQCP	Contractor Quality Control Plan
CSO	Caretaker Site Office
DFW	definable features of work
DOD	U.S. Department of Defense
DQO	data quality objective
DTSC	California Department of Toxic Substances Control
EPP	Environmental Protection Plan
ESS	Explosives Safety Submission
FID	flame ionization detector
Gilbane	Gilbane Federal
HAZWOPER	hazardous waste operations and emergency response
HDPE	high density polyethylene
HSP	Health and Safety Plan
IDW	investigative-derived waste
IR	Installation Restoration
LBP	Lead Based Paint
LLRO	low level radioactive object
LLRW	low level radiological waste
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
mg/kg	milligrams per kilogram
MNA	monitored natural attenuation
NAVFAC SW	Naval Facilities Engineering Command Southwest
Navy	U. S. Department of the Navy

NEDD	NIRIS Electronic Data Deliverable
NIRIS	Naval Installation Restoration Information Solution
NOSSA	Naval Ordnance Safety and Security Activity
NRC	U.S. Nuclear Regulatory Commission
NSTI	former Naval Station Treasure Island
NTCRA	non-Time Critical Removal Action
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
pCi/g	picocurie per gram
PMO	Program Management Office
PVC	poly vinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
Ra-226	radium 226
RAB	Restoration Advisory Board
RACR	Remedial Action Completion Report
RAOs	remedial/removal action objectives
RASO	Radiological Affairs Support Office
RCA	radiologically controlled area
RG	remediation goal
RMDP	Radiological Management and Demolition Plan
ROICC	Resident Officer in Charge of Construction
RPM	Remedial Project Manager
RSY	radiological screening yard
SAP	Sampling and Analysis Plan
SF PUC	San Francisco Public Utilities Commission
SOPs	standard operating procedures
SSHO	Site Safety Health Officer
SSHP	Site Safety and Health Plan
SWDA	Solid Waste Disposal Area
T&D	transport and disposal
TCP	Traffic Control Plan
TI	Treasure Island
TIDA	Treasure Island Development Authority
TPH	Total Petroleum Hydrocarbon
USEPA	U. S. Environmental Protection Agency
UXO	unexploded ordnance
Water Board	California Regional Water Quality Control Board, San Francisco Bay Region
WMP	Waste Management Plan

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1.0 INTRODUCTION

Gilbane Federal (Gilbane) prepared this Remedial Action/Non-Time Critical Removal Action Work Plan to describe activities to be performed in non-Solid Waste Disposal Areas (SWDAs) within Installation Restoration (IR) Site 12 (Old Bunker Area) and to continue the IR Site 12 non-Time Critical Removal Action (NTCRA) at the North Point SWDA at the former Naval Station Treasure Island (NSTI) in San Francisco, California (Figure 1). Groundwater monitoring in the Gateview Arsenic/Total Petroleum Hydrocarbons (TPH) Area that is within IR Site 12 also will be performed.

Gilbane is contracted through the Naval Facilities Engineering Command Southwest (NAVFAC SW) Radiological Multiple Award Contract, Contract Number N62473-17-D-0005, Contract Task Order F4239. Approval of planning documents and reports will be granted by NAVFAC SW and the State of California as represented by the Department of Toxic Substances Control (DTSC) and the Regional Water Quality Control Board San Francisco Bay Region (Water Board).

1.1 PROJECT OBJECTIVES

IR Site 12 contains soil and groundwater with elevated concentrations of the following chemicals of concern (COCs).

- Soil
  - Lead
  - Polycyclic aromatic hydrocarbons (PAHs) as benzo(a)pyrene equivalents (BaP EQ)
  - Polychlorinated biphenyls (PCBs) as total aroclors
  - Dioxins as 2,3,7,8- tetrachlorodibenzo-p-dioxin toxicity equivalent (TCDD TEQ
- Groundwater
  - Arsenic
- Radium 226 (Ra-226) (applicable to both matrices)

As stated in the *Final Record of Decision/Final Remedial Action Plan for Installation Restoration Site 12 (Non-Solid Waste Disposal Areas and Non-Radiological) Former Naval Station Treasure Island San Francisco, California* (IR Site 12 Non-SWDA/Non-Radiological

ROD; Navy, 2017), the Navy will address other chemical in soil, although these chemicals were not identified as COCs in the human health or ecological risk assessments. The Navy has identified remediation goals for pesticides and chromium. The other chemicals being addressed in soil are as follows:

- Total Chromium
- Pesticides (4,4-dichlorodiphenyldichloroethane [4,4-DDD] and alpha-benzene hexachloride [alpha-BHC]

The intent of this remedial action/NTCRA is to complete the work to support no further action for COCs in the IR Site 12 non-SWDAs and the North Point SWDA as described in the following documents:

- IR Site 12 Non-SWDA/Non Radiological ROD (Navy, 2017)
- *Action Memorandum/Interim Remedial Action Plan: Non-Time Critical Removal Action for Solid Waste Disposal Areas, Installation Restoration Site 12, Old Bunker Area* (Navy, 2007).

The remedial/removal action objectives (RAOs) are to reduce risk to current and future residents by minimizing dermal contact with incidental ingestion of, and inhalation of soil containing known COCs. The RAOs will be achieved by excavating discrete locations of soil with COCs above the remediation goals (RGs) and disposing of the soil off-site. This includes confirming that Ra-226 soil concentrations are below the release criteria. The RGs and release criteria are discussed in detail in Section 3.0. Groundwater monitoring is associated with this project, but achieving the RAOs for groundwater is not a performance objective. Ongoing groundwater monitoring at the Gateview Avenue area is part of the selected remedy for IR Site 12 documented in the IR Site 12 Non-SWDA/Non-Radiological ROD (Navy, 2017).

A secondary objective of the IR Site 12 non-SWDA remedial action is to collect radiological data representative of post-remedial action or "as-left" conditions of each excavation to better inform the IR Site 12 conceptual site model for non-SWDAs as to the presence and extent of radioactive contamination due to housing construction grading.

1.2 SCHEDULE

Planning activities are scheduled to commence immediately upon award. It is anticipated that this Work Plan will be submitted on July 30, 2018. Mobilization to commence field support activities will begin on August 10, 2018 with site work and field implementation starting on August 22, 2018. The field activities are expected to continue for a period of three months with demobilization occurring on December 4, 2018. The Remedial Action Completion Report (RACR) for the IR Site 12 non-SWDA remedial action is scheduled for issue on June 5, 2019.

1.3 WORK PLAN ORGANIZATION

This Work Plan has been structured to provide details regarding the three major aspects of this task order: (1) the non-SWDA remedial action, (2) the North Point SWDA NTCRA, and (3) the Gateview Arsenic/TPH Area groundwater monitoring. It is divided into the following sections:

- Section 1.0 Introduction – Describes the project objectives, schedule, and Work Plan organization.
- Section 2.0 Site Conditions – Describes the site conditions and background of IR Site 12, including the physical setting and other regional information, the results of previous investigations, and the nature and extent of contamination.
- Section 3.0 Regulatory Framework – Summarizes the regulatory framework, RGs, and radiological criteria.
- Section 4.0 Project Requirements – Describes the project requirements.
- Section 5.0 Field Support Activities – Describes field support activities including mobilization, community relations, notifications, pre-mobilization meetings, site security, permitting, and utility clearance.
- Section 6.0 Site Work and Field Implementation – Describes the field activities that will be performed.
- Section 7.0 Field Close-Out Activities – Describes the field close-out activities, including site restoration, inspections, and demobilization.
- Section 8.0 Remedial Action Completion Report – Outlines the main features to be included in the RACR for the IR Site 12 non-SWDA remedial action.
- Section 9.0 References – Lists references used in preparing this Work Plan.

The Work Plan also includes the following appendices:

- Appendix A Sampling and Analysis Plan (SAP; includes Field Sampling Plan and Quality Assurance Project Plan [QAPP]) – Details soil, groundwater, and waste sampling requirements, analytical methods, and quality assurance (QA)/quality control (QC) procedures to be used throughout the project.

- Appendix B Waste Management Plan (WMP) – Documents the requirements in the generation, storage, sampling and analysis, waste profiling, transportation, treatment, and ultimate disposal of all waste for the task order.
- Appendix C Traffic Control Plan (TCP) – Details road closures and other traffic controls to be in effect during remediation activities.
- Appendix D Contractor QC Plan(CQCP) – Addresses lines of communication, technical review procedures, activity documentation, definable work features, quality control staff and their responsibilities, proposed outside organizations (vendors, subcontractors) and their responsibilities and reporting requirements, project inspection requirements, required submittals, and other procedures to be followed to ensure technical quality throughout the project.
- Appendix E Radiological Management and Demolition Plan (RMDP) – Describes the process for radiological surveys on interior and exterior surfaces of Buildings 1126 and 1217 prior to demolition, the process required for asbestos and lead based paint (LBP) abatement prior to demolition, and the demolition of the buildings.
- Appendix F Environmental Protection Plan (EPP) – Addresses the controls to be put in place during the remediation activities for the purpose of protecting the environment. It includes a Storm water Plan and Dust Monitoring and Control Plan.
- Appendix G Work Notices – Describes the notices to be delivered to stakeholders that explain the work in plain language yet of sufficient detail to inform residents of what to expect and how the work will be accomplished.
- Appendix H Response to Comments (Final Work Plan only)

In addition, a Health and Safety Plan (HSP) that includes an Accident Prevention Plan (APP) and Site Safety and Health Plan (SSHP) has been prepared as a separate document for work activities at IR Site 12 (Gilbane, 2018). These plans address health and safety hazards associated with the field activities as well as describing air monitoring and dust control measures.

2.0 SITE DESCRIPTION AND BACKGROUND

This section provides a general overview of the site history, site conditions, and land use as documented in the IR Site 12 Non-SWDA/Non-Radiological ROD (Navy, 2017). In addition, this section summarizes previous investigations and the nature and extent of contamination.

2.1 FORMER NAVAL STATION TREASURE ISLAND HISTORY

NSTI is located in the City and County of San Francisco (CCSF), California, between San Francisco and Oakland in San Francisco Bay (Figure 1). NSTI consists of two contiguous islands connected by a causeway. Treasure Island encompasses approximately 403 acres, and the southern island, Yerba Buena Island, encompasses approximately 147 acres. TI was constructed of materials dredged from the San Francisco Bay from 1936 to 1937 for the Golden Gate International Exposition of 1939 and 1940. Yerba Buena Island is a natural rock island.

In 1940, the U.S. Department of the Navy (Navy) began leasing TI from the CCSF and later, during World War II, gained full ownership of TI. The island became a major Navy base and was used primarily for training, administration, housing, and other support services to the U.S. Pacific Fleet. In 1993, the Base Realignment and Closure (BRAC) Commission, pursuant to the Defense BRAC Act of 1990, recommended closure of NSTI. The base was closed on September 30, 1997.

2.2 INSTALLATION RESTORATION SITE 12 HISTORY

IR Site 12 is located on the northeastern part of the island (Figure 2). During the Golden Gate International Exposition in 1939 and 1940, the majority of the area that now encompasses IR Site 12 was used for vehicle parking. After the Navy took over the lease of NSTI and throughout the 1940s, 1950s, and 1960s, ammunition bunkers were located in the northern half of IR Site 12. From the early 1940s until about 1968, 21 ammunition bunkers were located in the IR Site 12 area. Disposal units and general SWDAs were in the vicinity of some bunkers. The southern part of IR Site 12 also included part of a former runway, general storage, fueling station, and miscellaneous buildings. From approximately 1966 to 1988, four military housing series (1100, 1200, 1300, and 1400 series) were constructed at IR Site 12. The 1100, 1200, 1300 and 1400 series buildings were completed in 1966, 1969, 1974 and 1988, respectively.

IR Site 12 was included in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process in 1988 because of findings in the Final Preliminary Assessment/Site Inspection report (Dames and Moore, 1988). These findings documented the potential for soil and groundwater contamination from debris that may not have been entirely removed during housing construction. The concentrations and distribution of COCs and solid waste within the residential housing areas are uncertain because of the variable distribution of solid waste and COCs resulting from grading operations. In 2002, the IR Site 12 boundary was expanded to include all existing residential areas.

2.3 TREASURE ISLAND SITE CONDITIONS

Following is a description of the environmental site conditions at Treasure Island.

2.3.1 Winds

The prevailing wind direction for the Bay Area is from the northwest. Wind speed is less than 6 miles per hour more than 50 percent of the time and exceeds 12 miles per hour approximately 10 percent of the time. The strongest winds are associated with winter storms.

In the winter, winds from the north and east sometimes bring low temperatures to the Bay Area. Westerly winds predominate during the summer when cool marine air flows east toward the warm Central Valley region of California. These winds are strongest in the late afternoon and early evening (TriEco-Tt, 2012).

2.3.2 Temperature

Temperature at Treasure Island is influenced by the Pacific Ocean and the resulting maritime climate. Temperature data have been collected at the Oakland Museum (the nearest weather station) for a 30-year period of record. The average annual temperature is 59.5 degrees Fahrenheit (°F), the average summer temperature is 64.8 °F, and the average winter temperature is 52.2 °F. The warmest month of the year is usually September (average temperature 74.6 °F). Daily extremes for the period of record are 107 °F (recorded on June 8, 1973) and 26 °F (recorded on December 9, 1972) (Navy, 1987).

2.3.3 Precipitation

Precipitation data have been collected at the Oakland Museum for a 30-year period of record. The average annual precipitation is 21.3 inches. The average precipitation by season is the spring is 4.8 inches in spring, 0.3 inches in summer, 4.3 inches in fall, and 11.9 inches in winter. Approximately 90 percent of the annual precipitation occurs from November to April with 19.2 inches of rain. Localized showers are infrequent and storms are generally moderate in duration and intensity. The maximum rainfall recorded in a 24-hour period was 4.74 inches on January 4, 1982.

Mean annual evaporation is 48 inches; the greatest evaporation occurs during July (Navy, 1987).

2.3.4 Humidity

Relative humidity during the winter is approximately 50 to 60 percent during the day, increasing to approximately 80 to 90 percent at night. Humidity decreases in the spring; however, by summer, it increases when frequent fogs occur, particularly at night or in the morning. Humidity is lowest in the fall, ranging from approximately 50 percent during the day to 70 percent at night (Navy, 1987).

2.3.5 Topography, Geology and Hydrogeology

Treasure Island is a relatively flat manmade island, consisting primarily of sediment dredged from the Bay and retained by a perimeter of rock and sand dikes. In general, the soil found is poorly graded, fine-grained sand with occasional discontinuous lenses of silt and clay. The groundwater table is encountered at an average depth of approximately 5 feet below ground surface (bgs) but may be shallower in the removal action areas. Generally, groundwater flow is radial from the center of the island toward the shoreline.

IR Site 12 is flat, consisting of open grassy areas between buildings, paved roads, and parking areas.

2.4 LAND USE

IR Site 12 was leased to the Treasure Island Development Authority (TIDA), and TIDA subsequently subleased select housing units. Currently, IR Site 12 contains residential buildings (about 900 housing units) that are two-story structures constructed with slab-on-grade foundations with four to eight residential units per building.

Following environmental restoration of the site, the entirety of IR Site 12 will be transferred to the CCSF. Redevelopment plans by the CCSF are described in the *Naval Station Treasure Island Reuse Plan - Public Review Draft* (CCSF, 1996) and *the Treasure Island/Yerba Buena Island Final Environmental Impact Report* (CCSF, 2011).

Redevelopment plans include designated areas for Residential, Open Space, Publicly Oriented Uses, and Shoreline Open Space.

2.5 PREVIOUS IVESTIGATIONS, REMOVAL ACTIONS, AND TREATIBILITY STUDIES

Table 10-1 in SAP (Appendix A) Worksheet #10 summarizes the previous investigations completed for IR Site 12 as well as the previous and ongoing removal actions.

2.6 EXTENT OF CONTAMINATION

A summary of the extent of COCs in soil and the associated excavations planned at IR Site 12 are presented in detail in SAP (Appendix A) Worksheets #17 and #18.

3.0 REGULATORY FRAMEWORK

This section summarizes the regulatory framework, RGs, and radiological criteria associated with this remedial action/NTCRA.

3.1 OVERVIEW

The U.S. Department of Defense (DOD) developed the IR Program in 1981 to comply with CERCLA and other federal and state environmental regulatory requirements. The IR Program is specific to military facilities and its purpose is twofold: (1) to identify, investigate, and clean up or control releases of hazardous substances and (2) to reduce the risk to human health and the environment in a cost effective manner. The applicable environmental requirements are in the following programs:

- CERCLA Program
- Petroleum Program
- PCB Program
- Residential LBP program
- Asbestos-Containing Material (ACM) Program
- Radiological Program

As the lead federal agency, the Navy, including the Radiological Affairs Support Office (RASO), is working with DTSC and the Water Board to develop and implement the remedial action/NTCRA. The Navy coordinates activities at NSTI with the regulatory agencies under the terms of the 1992 Federal Facility Site Remediation Agreement. Navy, DTSC, and Water Board representatives are collectively referred to as BRAC Cleanup Team (BCT) for NSTI. In addition, the California Department of Public Health (CDPH) works with DTSC to provide technical support on the radiological program. Other agencies and organizations also provide support to the BCT and the environmental program, including TIDA, the Treasure Island Community Development, the Restoration Advisory Board, the U. S. Environmental Protection Agency (USEPA), and other public groups.

3.2 REMEDIATION GOALS

The COCs and their associated RGs are presented in Exhibit 1. The values for the IR Site 12 non-SWDA remedial action COCs are taken from the IR Site 12 Non-SWDA/Non-Radiological ROD (Navy, 2017). The values for the North Point SWDA NTCRA COCs are the same as those for the non-SWDA remedial action. They are found in the *Action Memorandum/ Interim Remedial Action Plan: Non-Time Critical Removal Action for Solid Waste Disposal Areas Installation Restoration Site 12 Old Bunker Area Naval Station Treasure Island San Francisco, California* (Action Memo; Navy, 2007).

Exhibit 1. Remediation Goals for Soil and Groundwater

Constituent	Remediation Goals	
	Soil (mg/kg)	Groundwater (ug/L)[1]
Lead	400	--
Total Chromium	280[2]	--
PAHs as BaP EQ	0.62	--
PCBs at total aroclors	1.0	--
Pesticide (4,4-DDD)	2.0[3]	--
Pesticide (alpha-BHC)	0.077[3]	--
Dioxins as 2,3,7,8-TCDD TEQ	12 ng/kg	--
Arsenic	N/A	36[4]

Notes:

1 TPH does not have a remediation goal for groundwater. Qualitatively, the goal for dissolved TPH will be mass reduction via target cleanup goals in soil (including any measurable free product) to support the numeric remedial goal for arsenic in groundwater.

2 Total chromium is not a COC. However, the Navy will excavate isolated locations with an RBC goal of 280 mg/kg.

3 Pesticides (4,4-DDD and alpha-BHC) are not COCs. However, the Navy will excavate isolated locations with an RBC goal of 2.0 and 0.077 mg/kg, respectively.

4 Goal from Tier 1 Screening-Level Ecological Risk Assessment for Treasure Island (IR Sites 6, 12, 21, 24, 30, 31, 32, and 33), Naval Station Treasure Island, San Francisco, California prepared by SulTech for U.S. Department of the Navy, BRAC PMO West, March 23.

Acronyms:

BaP EQ	benzo(a)pyrene equivalents
BHC	alpha-benzene hexachloride
BRAC PMO	Base Realignment and Closure Program Management Office
COC	contaminants of concern
DDD	dichlorodiphenyldichloroethane
IR	Installation Restoration
mg/kg	milligrams per kilogram
N/A	not applicable
ng/kg	nanograms per kilogram
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
RBC	risk-based concentration
TCDD TEQ	tetrachlorodibenzo-p-dioxin toxicity equivalent
TPH	Total Petroleum Hydrocarbon
ug/L	micrograms per liter

3.3 RADIOLOGICAL CRITERIA

The radionuclide of concern is Ra-226. The radiological criteria are given in Exhibit 2.

Exhibit 2. Radiological Criteria for Ra-226

Total Surface Radioactivity[a]	Soil (or Volumetric) Radioactivity[b]	Dose[c]
100 dpm/100 cm^2	1.69 pCi/g	12 millirem/year

Notes:

[a] from Table 3 of U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide 8.23, *Radiation Safety Surveys at Medical Institutions* (NRC, 1981); removable surface radioactivity is limited to 20 percent of total surface radioactivity

[b] based on screening level previously used at NSTI of 1.0 pCi/g above background; background assumed to be 0.69 pCi/g from memorandum titled "*Analysis of Gamma Survey and Ra-226 Soil Concentration Data at the Treasure Island Site-Wide Background Areas and the Area 7 Background Reference Area*" (Shaw, 2012)

[c] total effective dose equivalent to an average individual reasonably expected to receive the greatest exposure to residual radioactivity based on USEPA Office of Solid Waste and Emergency Response (OSWER) Directive 9200.4-40, *Radiation Risk Assessment at CERCLA Sites: Q&A* (EPA, 2014); calculated using RESRAD-ONSITE for Windows, Version 7.2 (Argonne National Laboratory [ANL], 2016)

This remedial action/NTCRA will also include radiological controls, surveying, screening, potential object retrieval, characterization, and sampling to ensure worker(s) and community health and safety within the project area footprint(s) as is described in the RMDP.

4.0 PROJECT REQUIREMENTS

This section provides information related to the individual requirements to complete the remedial action/NTCRA at IR Site 12.

4.1 SAMPLING AND ANALYSIS PLAN

A SAP was prepared and is included as Appendix A to this Work Plan. The SAP includes sampling methods, procedures, and QA/QC requirements to be followed during execution of this task order.

The SAP, which includes a Field Sampling Plan and QAPP was prepared in accordance with the Uniform Federal Policy guiding the development of QAPPs and the DOD Policy and Guidelines for Acquisitions Involving Environmental Sampling or Testing. The SAP was written in accordance with applicable regulatory guidance documents and NAVFAC Environmental Work Instructions. The SAP describes the approach to the remedial action/NTCRA and sampling requirements.

4.2 WASTE MANAGEMENT PLAN

A WMP was prepared and is included as Appendix B to this Work Plan. The WMP includes information regarding waste management of liquids, soil, concrete, asphalt, and miscellaneous construction debris to be followed during implementation of project work. The contractual, legal, and risk-management requirements in the generation, storage, sampling and analysis, waste profiling, transportation, treatment, and ultimate disposal of waste are documented in the WMP. Additionally, waste generated during fieldwork will be safely managed and disposed in accordance with applicable laws and regulations.

The WMP covers both wastes to be remediated under this task order and investigative-derived waste (IDW) generated during the remediation activities. It includes:

- a description of the wastes expected by type;
- a description of minimization techniques for reducing the generated quantities of IDW, including recycling activities associated with building demolition (as appropriate);
- a review of applicable federal, state, and local regulatory criteria governing the management of these materials;

- a characterization rationale for solid and liquid waste materials;
- a rationale for on-site management of each expected waste type; and
- waste transportation, treatment, and disposal methods for fieldwork.

4.3 TRAFFIC CONTROL PLAN

A TCP was prepared and is included as Appendix C. The TCP details the road closures and other traffic controls to be in effect during remediation activities. This plan includes provisions and notifications of:

- road closures and/or residential parking areas;
- identification of approved truck routes, holding, and queuing areas;
- controlling traffic near the project site (if necessary); and
- site preparation and provisions for use of access roads by use of signage, barricades, signals, flagman, and/or other methods to minimize the impact on daily activities of the Treasure Island community.

4.4 CONTRACTOR QUALITY CONTROL PLAN

A CQCP was prepared and is included as Appendix D to this Work Plan. The CQCP describes QC actions and procedures that will be followed during execution of work. The CQCP includes a description of the QC organization, roles and responsibilities, a submittal register, reporting procedures, and a list of definable features of work (DFW) to be performed.

The CQCP follows the three phases of control for each DFW and meets the requirements of the Unified Facilities Guide Specification for QC. The primary function of CQCP is to assure the completed project meets all quality requirements of the contract. Government QA will be conducted during the field effort through reviews and inspections by designated representatives. The CQCP was prepared per the current version of Unified Facilities Guide Specifications (01 45 00.00 20 dated November 2011) and includes:

- a description of the QC organization, including a chart showing lines of authority;
- the names, qualifications, duties, authorities, and responsibilities of each person assigned a QC function;
- a description of onsite and offsite work as well as the work sequence; a schedule for managing submittals, testing, inspections, QA audits, meetings, three phases of control, and any other QA function (including functions of contractors, subcontractors, fabricators, suppliers, purchasing and agents, etc.) that involves assuring quality

workmanship, verifying compliance with the plans and specifications, or any other QC objectives.

- a description of how the remediation activities comply with environmental requirements including air quality, emissions monitoring records, waste disposal records, etc.;
- reporting procedures and reporting format for CQCP activities including such items as daily summary reports, schedule of data submissions, inspection data sheets, results of QA fieldwork audits, problem identification and corrective measures reports, evaluation reports, acceptance reports, and final documentation;
- a list of DFWs to be performed separate and distinct from other tasks with separate control requirements.

4.5 RADIOLOGICAL MANAGEMENT AND DEMOLITION PLAN

A RMDP was prepared and is included in Appendix E to this Work Plan. The RMDP addresses procedures and methodology for radiological surveys of buildings prior to asbestos and/or lead abatement and demolition activities in sufficient detail to complete all radiological scanning and sampling, associated characterization and demolition of building materials, slabs, footings and all building appurtenances. The overall goal for excavation areas is to collect, document, and report information which would be sufficient for a radiological characterization study. The plan includes details on interior and exterior gamma scanning, alpha/beta contamination surveys, sample collection and laboratory analyses, the types of equipment that will be used, calibration details, how survey units will be setup and classified, and how the building materials will be released and disposed. The plan was prepared using guidance from RASO and the *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM; DOD et al, 2000). It also includes a section to address LBP and ACM. Due to the age of the buildings, it is possible to encounter both LBP and/or ACM. The RMDP describes the methods to address LBP and/or ACM in accordance with applicable regulations prior to demolition of structures.

4.6 ENVIRONMENTAL PROTECTION PLAN

An EPP was prepared and is included as Appendix F to this Work Plan. The EPP includes a storm water plan, a dust control plan, and an air monitoring plan to be followed during implementation of the remedial action activities. Construction best management practices (BMPs) will be implemented to prevent offsite migration of visible and nonvisible pollutants. Construction activities will comply with the requirements of:

- The California State Water Resources Control Board's National Pollutant Discharge Elimination System General Permit (NPDES General Permit) No. CAS000002, "Storm water Discharges Associated with Construction and Land Disturbance Activities" Order Number 2012-0006-DWQ (which amends 2009-0010-DWQ, as amended by 2010-0014-DWQ)
- "San Francisco Bay Basin (Region 2) Water Quality Control Plan (Basin Plan)" (SFRWQCB, 2007)
- Bay Area Air Quality Management District (BAAQMD) Regulation 6, Rule 1 (BAAQMD, 2007)

4.7 WORK NOTICES

Written work notices will be prepared in coordination with TIDA and other stakeholders that will be hand delivered or mailed to all residents in the neighborhood. Work notices, described in additional detail in Appendix G, will describe the work in plain language and be of sufficient detail to inform residents of what to expect and how the work will be accomplished safely with BMPs for the control of soil, groundwater, storm water, dust, petroleum odors, etc. Work notices specific to small work areas will be provided for Navy and TIDA review prior to distribution.

4.8 HEALTH AND SAFETY PLAN

An HSP that includes an APP and SSHP has been prepared as a separate document. In accordance with FAR 52.236-13, this plan is site-specific and includes an activity hazard analysis (AHA) for each DFW. The HSP will be amended if appropriate and the AHA will be a "living" document with periodic reviews in the field and subsequent revisions as conditions warrant. A copy of the HSP will be maintained on site.

The APP is intended as guidance for the Site Safety Health Officer (SSHO) on conducting field work, responding to changing conditions, and making professional judgments based on monitoring data and related hazard control measures. As such, the APP identifies the health and safety responsibilities and reporting requirements for project field and office personnel, specifies necessary training, identifies health and safety program plans applicable to the project scope of work, and specifies site-specific hazards and controls.

The SSHP provides a detailed discussion of the potential site-specific physical and chemical or biological hazards associated with the site work and the measures that must be implemented for protection of the site personnel and the surrounding community. Among other safe work practice measures provided by the APP, the SSHP includes the AHA for each field activity to be conducted, the personal protective equipment that will be necessary, and the emergency response action plan for the site.

5.0 FIELD SUPPORT ACTIVITIES

This section describes the activities to be conducted for the remedial action/NTCRA prior to commencing formal construction activities.

5.1 PERMITS AND NOTIFICATIONS

Permits and notifications are required prior to initiating various phases of removal action activities. Necessary authorizations will be obtained from the Resident Officer in Charge of Construction (ROICC) and Caretaker Site Office (CSO) for implementing and completing work activities. An annual excavation permit from the California Occupational Safety and Health Administration will be maintained and required notifications will be made before excavation begins. A Dig Permit will be submitted and the San Francisco Public Utilities Commission (SF PUC) will be notified before excavation work begins. Permits will be obtained for connections to necessary services provided by utility companies serving the project area as needed.

5.2 MEETINGS

Coordinating efforts will be required with BRAC Program Management Office (PMO), RASO, the ROICC, the CSO, TIDA, and appropriate BRAC BCT members. Timely and open communication with BRAC, RASO, CSO, and ROICC is essential to project success and understanding the protocols of notification and coordination are crucial. A meeting will be coordinated with ROICC prior to initializing field mobilization. Attendees of this meeting will include the Gilbane Project Manager, Site Supervisor and key Gilbane personnel, Navy Remedial Project Manager (RPM), RASO, ROICC, CSO, and other appropriate Navy or project stakeholder personnel. The meeting will address health and safety, site security, scope of work, QA/QC procedures, access to the site locations, scheduling, and other field issues. A project schedule covering field activities will be provided. This meeting may be held in union with the Mutual Understanding Meeting as part of the CQCP.

The meeting will also discuss the lines of communication. For instance, RASO may provide guidance for radiological operations to the Navy and its contractors, but all direction in such matters is ultimately issued by the BRAC contracting officer and/or representative (usually the RPM). CSO personnel will be notified of any issues involving site access, security, facilities, and environmental compliance. Any health and safety issues or accidents will be reported to ROICC personnel, who provide QA oversight and therefore require timely notification prior to key events taking place.

5.3 COMMUNITY RELATIONS

Several community relations activities will be conducted to inform the public of the ongoing remedial activities and to encourage involvement in discussions and the review of relevant documents.

Gilbane will work with the Navy, ROICC, CSO, and TIDA as required to alert residents to upcoming field activities. Work notices detailing project activities and important facts for the community, discussed further in Appendix G, will be distributed as appropriate.

Gilbane will also provide support for RAB meetings to inform and involve the community in the status of the remedial action. Gilbane will provide support by attending the RAB meetings in person and assisting the Navy RPM in the preparation and presentation of a PowerPoint slide show of approximately 30 minutes. The presentation will be provided to the community relations coordinator (coordinator to be determined) in advance of the meetings.

5.4 WORK RESTRICTIONS

Work outside regular workday hours, including Saturdays, Sundays, and Government holidays, will not be performed unless permission is granted by the Navy RPM, ROICC or CSO in advance. It is anticipated that work hours for site activities will be Monday through Friday, between the hours of 7:00 A.M. and 4:00 P.M. Work areas will be left in a safe, secure condition when not attended.

5.5 MOBILIZATION

Mobilization activities will include site preparation, movement of equipment and materials to NSTI, the construction of temporary facilities and utilities as needed, and orientation and training of field personnel. Trucks, machinery, and equipment will be radiologically surveyed prior to initial use and decontaminated prior to first arrival, if required, and routinely throughout the project in accordance with standard operating procedures, and after completion of remedial activities. Survey records will be maintained onsite. The majority of equipment and materials will be mobilized to the site on an as-needed basis to minimize storage requirements. IR Site 32 will be used as a radiological screening yard (RSY) (Figure 3).

5.6 SITE SECURITY

The Navy worked with TIDA to have Buildings 1126 and 1217 vacated in anticipation of fieldwork. Although not currently scheduled for demolition, Building 1202 is also slated for vacancy due to its location within a portion of the remedial action area footprint. It is anticipated that Building 1202 will be vacant by mid 2018. Buildings 1126 and 1217were secured immediately upon vacancy with security systems to restrict access and provide deterrence from potential break-ins and vandalism.

An appropriate level of security will be provided for both workers and equipment and material before, during, and after working hours. Six-foot high fencing with privacy fabric will be installed around work areas, including excavations and equipment laydown and storage areas. As a general rule, material and equipment in danger of theft will be stored inside the secured fenced area. After-hours security will be provided by a contract security company.

During active excavation and transport and disposal (T&D) operations, local site access will be controlled by temporary barriers including warning tape and signage. Traffic control will be conducted in accordance with TCP provided as Appendix C. Prior public notice of any road closures will be provided as described in Appendix G.

5.7 SITE PREPARATION

The following site preparation activities will be performed, as applicable, at excavation locations.

5.7.1 Site Survey

A site survey will be performed prior to and upon completion of field work. A land surveyor, registered in the State of California, will perform an initial survey of site features to establish horizontal and vertical controls; nodes for a sampling grid system in larger excavations (to control the location of subsequent lifts and assist in the collection of confirmation samples); and existing grades. The excavation boundaries will be marked with white pavement-parking spray paint using solid line corner points with arrows pointing inward and dashed white lines outlining each excavation.

Following completion of excavation activities, and prior to backfilling, each excavation area will be surveyed. The confirmation and pre-excavation survey information will be compared to assess the total volume of excavated soil. The excavation volumes will be used to assist with the determination of the amount of backfill material required. The final grade of the site will be consistent with the pre-construction elevation and will account for removal of structures to ensure proper drainage and aesthetics of the area.

Additionally, a pre-construction photo survey of the existing infrastructure at the project site, including buildings, fences, pavement, walkways, appurtenances, etc. will be conducted so that possible impacts related to field activities can be assessed and appropriate repairs can be made at the end of the project.

For small, discrete excavations, surveying will be accomplished using a combination of a handheld GPS instrument and photographs.

5.7.2 Temporary Construction Facilities

Building 570 will serve as the administrative field office. A shipping container, if needed, will be staged at IR Site 32 as a working space and for storage of tools, small equipment, and non-radiological materials. Private vehicles of workers will be parked around Building 570 and only Gilbane and subcontractor vehicles will be used at work areas. Residential parking areas will be avoided.

The following utilities will be used on site during project execution.

- Construction water for dust control (further discussed in Appendix F).
- Communication: Two-way radios and cell phones will be used for on-site communications as required.
- Electrical: Power is available to Building 570. As required, generators fueled by diesel or gasoline will be used for electrical power.
- Potable water: Bottled water or potable water jugs will be provided for site workers.

- Sanitation facilities: Portable toilets and refuse containers will be set up near the work sites. Portable toilets will have non-potable water for hand-washing.

5.7.3 Screening and Stockpiling of Soil

IR Site 32 will be used as a radiological screening yard (RSY) to characterize and radiologically screen and stockpile excavated soil as needed to support excavation activities. Laydown pads and soil stockpile areas will be constructed as described in the RMDP (Appendix E).

Screened material may be stockpiled in the RSY if needed while awaiting RASO authorization for disposal. A sign or other physical marker will be used to identify each stockpile. Stockpiled soil will remain separate and segregated (i.e., each stockpile will consist of soil from a single screening on a given laydown pad) from other screened soil to retain data integrity and ensure there is no cross-contamination. Screened material will not be stockpiled in the event concerns of possible cross-contamination exist. Environmental protection measures (e.g., runoff/erosion control) will be implemented and maintained while the soil is stockpiled. Once approved by the Navy, the soil will be loaded and transported to the waste disposal facility.

Once the RSY is no longer needed, the laydown pads and soil stockpile areas will be deconstructed and the site returned to its pre-use condition. Chemical and radiological sampling will be performed and the area remediated as necessary so the “as-left” state of the site is consistent with its pre-use condition.

5.7.4 Equipment and Personnel Decontamination Facilities

A decontamination pad will be constructed as needed adjacent to the exit of the excavation areas. The decontamination pad will be constructed using a minimum of one 20-mil layer of high-density polyethylene (HDPE) or poly vinyl chloride (PVC) liner.

Prior to constructing the pad, the area will be cleared of rocks, debris, and other items that could puncture the liner. An initial radiological survey of the area may be performed to ensure no radiological interference and to establish base-line data for future radiological release of the area. A single-height course of sand bags or other devices will be placed around the perimeter of the decontamination pad to ensure that a bermed sump area is formed and fully contained by the impermeable plastic liner material. The liner will then be placed directly on the ground surface and the berm material. A minimum of 16-ounce non-woven geotextile fabric will be placed on the top of the liner. A 12-inch layer of ¾-inch drain rock will be placed over the geotextile fabric and sloped such that runoff is conveyed to a sump. Equipment to be decontaminated will drive over the rock layer, not the plastic liner. The purpose of this system is to prevent puncture of the HDPE or PVC liner; thereby preventing contaminated media from coming into contact with the native soil or pavement. In addition, to prevent rainwater from accumulating, the decontamination pad will be covered and secured with sandbags or equivalent during periods of heavy precipitation.

Gilbane will use dry decontamination methods to the maximum extent possible to clean excavators, backhoes, bins, trucks, and associated tools and equipment. Solids collected in the decontamination area will be stored in drums or appropriate containers and characterized for subsequent reuse or disposal. Liquids generated during decontamination activities will be pumped from the sump into an on-site tank for sampling, characterization, and disposal as described in the SAP (Appendix A) and WMP (Appendix B). Personnel decontamination areas may be established at work areas, as required in the HSP.

5.8 STORMWATER MANAGEMENT

Storm water management activities, described in detail in the EPP (Appendix F), will include the identification and implementation of BMPs to reduce sources of sediment and other pollutants that may affect storm water discharges.

5.9 UTILITIES

It is anticipated that utilities within and surrounding IR Site 12 may interfere with field work. Appropriate utility as-built drawings, will be obtained and reviewed. Gilbane will complete a utility clearance and work with the Navy, TIDA, SF PUC, and other stakeholders to identify and mitigate potential impacts to utilities.

Underground utility clearance will be completed prior to initiating intrusive activities. Efforts to locate and clear utilities will include, as appropriate:

- Field observations of surface expressions (cleanouts, risers, manholes) will be used as guides during the utility marking work;

- Geophysical methods, including electromagnetic induction, magnetometry, and/or ground-penetrating radar, will be used to clear areas of intrusive activity of potential subsurface obstructions prior to soil excavation;
- Proposed limits of intrusive activity and the utility lines in the immediate vicinity, will be marked using color-coded surveyor paint; and
- Underground Service Alert will be notified and a meeting with interested parties that will potentially be affected by the intrusive activities will be scheduled.

Utility line locations will be marked using color-coded surveyor paint and American Public Works Association-approved colors.

Intrusive (i.e., soil disturbing) work will be performed under radiological controls appropriate to the activity. During excavation activities in the vicinity of identified utilities, a construction laborer (spotter) may be used to guide excavation equipment and view excavations for buried utilities as soil is removed. Hard pipes (steel or small-diameter PVC) will be maintained as much as possible during the excavation. Brittle pipes (vitrous clay) will be demolished and replaced (if required). Abandoned utilities (especially transite pipe) may either be removed to a depth of 5 feet and properly disposed or left in place; utilities that are no longer active will not be replaced. Open ends of pipes remaining after sections of pipes have been removed will be permanently plugged using concrete to prevent creating a new subsurface conduit. In the event that an active utility line is broken or damaged, the NSTI utility manager will be contacted and, as appropriate, affected people will be notified. Utilities will be repaired by Gilbane and/or other subcontractors as appropriate. Broken or damaged utilities will be replaced in-kind or with other materials that meet current industry standards (i.e., clay drainpipes may be replaced with acrylonitrile butadiene styrene piping, steel water pipes may be replaced with PVC piping).

Gilbane does not anticipate any planned interruptions to utilities during fieldwork. However, in the event of an unexpected interruption, the outage will be remedied so disruption to site residents is minimal. Hand digging to complete the excavations/sampling may be required to avoid disruption of service. If utilities need to be disconnected to complete field work, Gilbane will coordinate these activities, providing bypass utility service during the remedial action implementation, and replace these utilities upon completion. Connections and/or disconnection of utilities will be coordinated with SF PUC and Navy ROICC and CSO.

5.10 TRAFFIC CONTROL

Construction work performed within IR Site 12 may directly or indirectly impact vehicle parking areas, roadways, and pedestrian walkways on NSTI. The TCP is provided as Appendix C.

5.11 SITE SAFETY

A trained and qualified SSHO will be onsite during the remedial activities. Work will be performed in accordance with the HSP provided under separate cover.

5.12 ENVIRONMENTAL PROTECTION

Work performed under this Work Plan will be conducted in accordance with applicable environmental regulations as discussed in the EPP provided in Appendix F.

5.13 BEST MANAGEMENT PRACTICES

BMPs to be implemented for construction activities include, but are not limited to, waste minimization, environmental controls, and safe work practices.

5.13.1 Waste Minimization

Waste will be managed by type based on waste stream characteristics and disposal facility requirements. Measures will be taken to avoid comingling of waste types from demolition or excavation, through handling and transport for disposal. For example, building inspections will identify waste streams based on hazardous waste type and the waste will be managed accordingly. Similarly, excavations will be sequenced and managed by COC groupings (e.g., metals, PCBs, etc.) to facilitate RSY screening and subsequent waste characterization and handling. Additional details are provided in the WMP (Appendix B).

5.13.2 Environmental Controls

The implementation of environmental controls will be documented via photographic record and through written field notes to demonstrate project compliance with applicable rules and regulations. Additionally, constant evaluation of environmental controls by site management and QC personnel is crucial to ensure site controls are sufficient and appropriate for changing site conditions; controls will be modified as necessary to ensure continued efficacy. Environmental controls are discussed in detail in the EPP (Appendix F).

5.13.2.1 Dust Control and Air Monitoring Reporting

Gilbane will implement measures to minimize and control dust throughout building demolition, soil excavation, and RSY operation. A water truck or large mister will be used to prevent airborne dust and keep demolition debris and soil moist. A water truck will be used to wet down public roadways used for transport of soil outside of fenced areas. Soil stockpiles will be treated with a soil stabilizing agent that prevents airborne dust due to wind and minimizes runoff during rain events.

Airborne dust will be monitored visually on a continual basis. Visible dust will not be permitted during demolition activities. Demolition, excavation, stockpiling or other dust-generating activities will be halted should visible dust be released into the air. Work will be stopped during high wind conditions, including sustained wind speeds over 25 miles per hour. Dust action levels are presented in the EPP (Appendix F) and will be used as criteria to take action when necessary.

Air monitoring will be conducted at upwind and downwind locations, including during periods of non-activity such as weekends and holidays, to ensure workers and the public are adequately protected from airborne contaminants. COCs and airborne radioactivity will be included as part of the routine monitoring. Air monitoring data will be presented in an air monitoring report submitted every two weeks to the Navy Remedial Project Manager in a format suitable for on-line posting. Any exceedances will be documented in the report. Air sampling descriptions and field activities will be documented in the daily field logs and submitted as part of the daily quality control package to the Navy.

5.13.2.2 Petroleum Odors

The potential for emission of organic compounds during excavation and soil handling activities will be controlled by spraying excavations and soil stockpiles with water so that they are visibly moist. In addition, the stockpiles will be covered with a soil stabilizer as required. A flame ionization detector (FID) will be used to perform ambient air monitoring for organic compound emissions. Monitoring will be conducted upwind and downwind of the excavation area. In the event that FID monitoring results suggest the need for additional control measures as defined by the criteria presented in the EPP (Appendix F), exposed soil will be covered at the end of each workday and during periods of heavy precipitation or high winds by a 10-mil liner securely anchored by sandbags. As a contingency measure, odor neutralizers may be applied to open excavations and/or stockpiles.

5.13.2.3 Runoff Control

Sand bags will be used to divert water runoff from dust suppression activities to collection points away from adjacent storm drains. The RSY laydown pads and soil stockpiles will be constructed with berms to contain rainwater for collection and disposal. The collected runoff water will be sampled and treated, if necessary, prior to discharge. Storm water entry into open excavations will be prevented using temporary berms and the existing storm sewer system used for runoff management over the broader work areas. Hay bales or other typical means of sediment control will be used to prevent sediment entry into storm water inlets.

BMPs will be implemented to minimize the potential for pollution of storm water, including but not limited to, fiber rolls, hay bales, sand bags, and silt fence installation where applicable. Stockpiles will be underlain with plastic sheeting and encircled by fiber rolls and/or hay bales to minimize the potential for runoff.

5.13.2.4 Track-In/Track-Out

Building debris and excavated soil will be transferred by truck from the building demolition or excavation site to the RSY or off-island disposal facility. Wherever possible, trucks will be kept outside of controlled areas to minimize track-out of soil and debris. Loaded trucks will be tarped and loose dirt and debris cleaned off the truck dovetail and bed rail prior to transport. Transport routes are shown in Figure 4.

5.13.3 Safe Work Practices

Workers will receive hazardous waste operations and emergency response (HAZWOPER), radiation, and munitions awareness training. Those involved in demolition work also will be trained in hazardous waste handling and packaging. Workers will be briefed on hazards and controls specific to the planned work in daily safety meetings during and throughout the daily field activities. Safety postings, warnings, and rope barricades will be used to limit access to allow only essential personnel within work areas. Spotters will be used when equipment is in use near electrical lines and other active utilities or if there is any potential for contact. All workers have the authority and responsibility to stop work when controls are inadequate or imminent danger exists.

The likelihood of unplanned releases of contaminants that could threaten human health or the environment is considered low. In case of emergencies, Gilbane will implement the emergency response measures described in the HSP.

5.14 MUNITIONS RESPONSE

Munitions are not anticipated to be present in the remedial action/NTCRA areas. However, if munitions items are encountered, munitions oversight will be required for the remaining duration of the field work. Gilbane will employ a fully qualified unexploded ordnance (UXO) technician who is familiar with the UXO response process as well as Gilbane standard operating procedures (SOPs). Upon identification of UXO, the technician will implement the response plan, immediately evacuating the area of non-essential personnel. Gilbane will work with the Navy to implement the IDIQ line item for UXO clearance operations, prepare the Explosives Safety Submission (ESS) for draft submittal, and work with the project team to gain approval of the ESS through Naval Ordnance Safety and Security Activity (NOSSA). After approval is gained, Gilbane will implement the agreed upon appropriate munitions oversight and/or screening measures for the remaining duration of the field work.

Gilbane will employ a fully qualified UXO technician who is familiar with the UXO response process as well as Gilbane SOPs. Upon identification of UXO, the technician will implement our response plan, immediately evacuating the area of non-essential personnel. Gilbane will work with the Navy to implement UXO clearance operations, prepare the ESS for draft submittal, and work with the project team to gain approval of the ESS through NOSSA. After approval is gained, Gilbane will implement the agreed upon appropriate munitions oversight and/or screening measures for the remaining duration of the field work.

5.15 ASBESTOS CONTAINING MATERIAL AND LEAD BASED PAINT

Due to the age of the buildings, it is possible to encounter both LBP and/or ACM. It is assumed ACM will be present in materials including, but not limited to, pipe insulation, wallboard, mastic, flooring, and roofing materials. The methods to address LBP and/or ACM in accordance with applicable regulations prior to demolition of structures are described in the RMDP (Appendix E).

6.0 SITE WORK AND FIELD IMPLEMENTATION

This section describes the field activities that will be performed once project plans have been approved and the Navy has provided the notice to proceed.

6.1 IR SITE 12 NON-SWDA REMEDIAL ACTION

Up to 4,000 bank cubic yards of soil will be excavated from 58 discrete locations and two building demolition footprints, and screened, transported, and disposed of as appropriate. See Figure 2. For planning purposes, the 58 discrete locations are assumed to each measure 10 feet wide, 10 feet long, and range from 4 to 10 feet deep. The building demolition footprint of Building 1126 measures 80 feet wide and 170 feet long while the footprint of Building 1217 measures 80 feet wide and 130 feet long.

Field activities will begin with preparation for building demolition. Once the buildings are demolished and debris removed, the soil beneath the building footprints will be excavated. Concurrently a separate crew will conduct the soil excavations, confirmation sampling, and backfilling activities at the 40 discrete locations. Radiological screening and waste characterization of excavated soil at the RSY will support excavation activities. See the RMDP (Appendix E).

6.1.1 Preperation of Nearby Residential Buildings

The close proximity of the work to nearby residential buildings demands the highest level of coordination, communication, and accommodation. Gilbane’s focus will be to minimize disruptions to the neighbors. Street closures will be minimized and Gilbane will provide measures to limit the impact of dust to the residential buildings that could be impacted by the excavation and remedial activities as described in the EPP (Appendix F).

The blue concrete playground structure and adjacent tree near Halyburton Court area will need to be removed and will not be replaced following field work efforts. Additionally, should the large sandbox in this area need to be removed, it also will not be replaced.

6.1.2 Building Demolition

Demolition of the structures, appurtenances, concrete foundation slab, and asphalt will be conducted in accordance with the RMDP (Appendix E).

6.1.3 Pre-Excavation Soil Boring

A direct push rig (or equivalent) will be used to collect a vertical core boring at the discrete locations to be excavated. The soil core will extend beyond the soil COC exceedance depth. The analytical results will be used to delineate the vertical extent of the excavation to ensure the COC-containing soil is removed, and as a confirmation sample in accordance with the SAP (Appendix A).

6.1.4 Excavation

The initial lateral and vertical extent of each excavation is dictated by historical sample analytical results (Figure 2). Excavation sidewalls will be cut vertically for excavations shallower than 4 feet. Deeper excavations will be sloped or benched. Excavated soil will be direct loaded, where possible, into a dump truck staged next to the excavation, but outside the controlled area, and transported to the RSY. A conditional radiologically controlled area (RCA) will be established during loading activities and released once loading activities are completed. A water truck will be used to mist the soil with water during excavation, screening, and segregation activities to minimize the potential for dust.

6.1.5 Saturated Soil

If groundwater is encountered, rather than dewatering, saturated soil will be placed onto a plastic-covered area adjacent to the excavation to allow water to drain back into the excavation and the soil worked or turned to allow it to dry prior to transport. These temporary laydown areas will be constructed using a 60-mil HDPE welded liner to protect existing soil from contaminants. The perimeters of the laydown areas will be bermed to contain water. Additionally, the excavator may be equipped with a perforated "mud" bucket to allow excess water to drain back into the hole before moving the material. Appropriate environmental controls will be applied to mitigate potential contaminant release and cross contamination during soil draining. Other than temporarily placing soil immediately adjacent to an excavation, either while waiting to be loaded into a truck or allowing saturated soil to drain and dry, areas outside the RSY will not be used for soil laydown. The RSY pads may also function as soil drying pads. To avoid tracking material outside the excavation area, loose, muddy soil will be air dried to a damp state (based on visual observation) at the excavation site prior to transport to the RSY. All dump trucks transporting soil to the RSY will be lined and tarped.

Oversized soil and debris, if encountered, will be segregated from the soil and screened separately for proper disposal. Debris may include clay balls, rock, small pieces of asphalt, metal objects, plastic, glass, or other similar waste materials.

When the initial lateral extent of each excavation has been reached, confirmation samples will be collected from the sidewalls. Soil borings collected prior to excavation will serve as confirmation samples for vertical extent (see Section 6.1.3). If RGs for every COC are not achieved at the planned limits of excavation, excavations, including those previously backfilled, will be extended laterally or vertically until sample results confirm COC concentrations, including Ra-226, are below the RGs. Excavations may also be extended based on consultation with the Navy if there is visual confirmation of debris or if the soil is found to contain elevated radioactivity (in the form of elevated gamma activity). For sidewall exceedances, an additional 1-foot lateral step-out will be excavated the length of the wall up to 5 feet on either side of the sample location. For floor exceedances, an additional 1-foot vertical step-down will be excavated across a 5-foot by 5-foot floor area centered on the sample exceedance. The excavation step-out and step-down process will repeat until confirmation samples indicate COC concentrations are below the RGs.

Excavated material will be hauled off site for disposal after waste profile sampling, landfill waste acceptance, and waste profile approval as described in the WMP (Appendix B).

For small excavations (i.e., a single sample location exceeding the RGs), the excavation will be backfilled immediately to minimize neighborhood disruption. For larger excavations (i.e., multiple sample locations exceeding the RGs), the excavation will remain open pending results from confirmation sampling. For both safety and security, plastic water-filled jersey barriers will be placed around open excavations left unattended. The barriers will be surrounded by fencing with privacy fabric and posted with construction signs. Where warranted, radiological postings will be positioned so as to be visible to workers in accordance with the RMDP (Appendix E).

6.1.6 Possible Unknown Site Features

If any leach field lines, sumps, vaults, or other underground conveyances or containers are found during excavation activities, Gilbane and the Navy will discuss the situation and agree on an approach to properly decommission the feature. Options will include removal and backfilling with clean material where possible or the use of pressure-grouting equipment to inject grout/cement or neat cement into the feature where excavation is not feasible.

6.1.7 Confirmation Sampling

To demonstrate that soil exceeding the RGs has been removed, confirmation samples will be collected from the excavation floor and sidewalls as well as at suspect locations (e.g., visually discolored soil, highest gamma scan reading), if any, in accordance with the SAP (Appendix A). Four confirmation sidewall soil samples and one bottom soil sample will be collected for analysis from each excavation location to confirm and characterize the soil of the excavation areas. The results of the pre-excavation soil core samples (Section 6.1.3) will be used in lieu of the bottom sample. Pre- and post-gamma static readings will be collected where practical and safe to do so. For large excavations, samples will be collected every 50 linear feet of sidewall and in each area larger than a 50-foot by 50-foot survey grid of the excavation bottom. Step-out samples from over-excavated areas will be collected laterally once every 2 linear feet of sidewall and vertically once from each additional 2-foot by 2-foot area of excavation bottom. Where there is standing water, material from the desired sample location will be removed from the excavation using the excavator bucket or equivalent. A grab sample will be collected from the material once it has been allowed to drain.

Soil samples will be collected using inert sampling tools (disposable plastic scoops or stainless steel trowels) and placed in laboratory-provided sample containers. In the case of unshored/unsloped excavations deeper than 4 feet, soil samples will be collected utilizing the backhoe or excavator bucket. The operator will remove a relatively intact portion of the bottom or sidewall to provide the sampler sufficient material to safely collect the sample for analysis. Samples will be labeled, placed in appropriate laboratory-supplied, clean sample containers wrapped in re-sealable plastic bags, and placed on ice in an insulated cooler for transport to the analytical laboratory following standard chain-of-custody procedures. A DoD Environmental

Laboratory Accreditation Program and California-certified analytical laboratory will be used to analyze the samples for the COCs, including Ra-226, appropriate to the excavation from which the samples were collected and the sample results compared to the RGs.

Note that when saturated conditions are encountered in an open excavation and the pre-excavation soil cores are insufficient, the confirmation survey will be accomplished either using the excavator arm/bucket or by using a cherry picker to place the surveyor over the excavation to drop a pole to the excavation bottom.

The SAP (Appendix A) presents additional details on the confirmation sampling program, including: sample design; sample procedures; data quality objectives (DQOs); lists of analytes; appropriate sample containers to be used and volumes to be collected for each analytical suite; laboratory reporting limits; data handling; data validation; and database management.

6.1.8 Radiological Characterization

Radiological characterization will be completed in accordance with the RMDP (Appendix E) once confirmation sampling demonstrates that COCs are below the RGs. Gilbane possesses a radioactive materials license No. 7948-07 from the State of California that allows the performance of radiological survey and sampling, as well as the radioactive material handling that is required. Because IR Site12 is a radiologically impacted area, all field activity elements, include building demolition, soil excavation, confirmation sampling, and waste management will be performed under radiological controls appropriate to the activity. Gilbane will enter into a Memorandum of Understanding with the Navy and other radioactive material licensees at NSTI to ensure proper interfacing of radioactive material handling responsibilities. Corporate-level radiation safety SOPs will be used to implement field work. These SOPs provide controls necessary for radiologically safe operations essential to data quality. In situations involving ancillary radiological activities or to further augment the corporate-level SOPs, work instructions may be prepared to facilitate a specific activity. Work instructions will be provided to the Navy for review and approval. Copies will be maintained on-site during radiological work activities and will be available for review by regulatory agencies.

6.2 NORTH POINT SWDA REMOVAL ACTION

Concurrent with the IR Site 12 non-SWDA remedial action, 4,000 bank cubic yards of soil within the IR Site 12 NTCRA at the North Point SWDA will be excavated, radiologically screened, and disposed of as Class I CA hazardous waste. See Figure 3 for proposed excavation boundaries. The excavated area will be backfilled and the site restored. As part of the removal action, approximately 4,000 bank cubic yards of radiologically screened soil already staged at IR Site 32 also will be transported and disposed of as Class I CA hazardous waste. The removal action will be performed consistent with previously approved work plans (e.g., CB&I Federal Services, LLC [CB&I], 2015).

6.2.1 Soil Excavation

Soil excavation will involve handling and processing of the following three categories of soil:

- Impacted soil - Soil that is impacted with radiological and/or chemical contaminants, or with UXO. This soil may be present at previously identified locations with elevated sample results.
- Buffer backfill - Clean import fill (non-impacted) placed as backfill during previous removal actions and is located within one foot of the original excavation bottom or sidewall. Based on its proximity to impacted soil, up to 1-foot of buffer backfill soil will be radiologically screened with the intention to reuse as backfill material. Chemical characterization for this buffer material is not required as a result of pre-existing confirmation sample results showing that sidewalls met RGs.
- Clean backfill - Clean import fill (non-impacted) placed as backfill during the site restoration phase of previous removal actions and is located within the interior portions of the backfilled excavation (i.e., not including the 1-foot buffer). Clean backfill will be stockpiled separately for reuse as backfill material.

Excavations of impacted soil will be extended to incorporate existing areas known to exceed the RGs or radiological screening criterion. The planned excavation depth is established as 4 feet bgs based on the technical specifications in the historical grading plans implemented during construction of IR Site 12 housing (Navy, 2007). Low level radioactive objects (LLROs) containing Ra-226 are anticipated to be co-located with debris and excavation will continue until debris has been removed. If debris is encountered, confirmation sample results are above the RGs or the radiological screening criterion at the extent of the planned excavation footprint, the depth or lateral extent of excavation may exceed the 4-foot bgs depth following consultation with the Navy. Over-excavations may be conducted following close coordination with the Navy.

Excavation of impacted soil may cease prior to reaching the maximum depth prescribed in the Action Memo (Navy, 2007) of 4 feet bgs if visible debris is no longer observed.

Impacted soil will be excavated in concert with in-process gamma scans, loaded onto dump trucks for transport, and transferred to the RSY for radiological screening in accordance with the RMDP (Appendix E). Large debris may be segregated to separate staging areas within the immediate work area for further evaluation. Where possible, *in-situ* soil gamma scans (i.e., within the excavation) will be conducted to identify potential radiological anomalies prior to loading impacted soil for transport to the RSY. If saturated soils or groundwater is encountered, the soil will be excavated and placed on adjacent pads or equivalent in preparation for radiological surveys.

6.2.2 Saturated Soil

The depth to groundwater ranges from approximately 3 to 5 feet bgs in the IR Site 12 area. Tidal influence will cause fluctuations in groundwater levels, especially close to the perimeter, and excavations may fill with rainwater during storms. Excavations will be dewatered as necessary and to the extent practical to access excavation bottoms and sidewalls to safely remove soil that exceeds the RGs and/or screening criterion and inspect for debris or evidence of past disposal activities. Given the location of IR Site 12 next to the San Francisco Bay, it is not anticipated that excavations can be fully dewatered. Excavations will proceed using best management procedures and only smaller areas will be opened one at a time to avoid collection of large volumes of surface and ground water. Consequently, only smaller excavations are planned for dewatering as necessary. If excavations containing known elevated COCs or Ra-226 require dewatering to meet the RAOs, excavation will be planned around lower tide cycles. Collected water will be contained in tanks or equivalent and processed prior to disposal.

Surface water including rainwater collecting on RSY pads or ponding water from low spots within the project site will be sampled for disposal in the sanitary sewer. Water from excavations requires approval of sampling results by RASO prior to disposal.

Although not expected, water generated from dewatering activities, if collected or containerized, will be subject to the storage and treatment requirements described in the WMP (Appendix B).

6.2.3 Confirmation Sampling and Analysis

Confirmation soil sampling will be conducted in completed excavations and the samples analyzed for the COCs as described in the SAP (Appendix A) Worksheets #17 and #18. Chemical confirmation samples collected and analyzed for the full set of COCs (lead, PCBs, PAHs, dioxin/furans) will be used to support the final site no further action decision.

Initially, the soil sample will be analyzed for the primary COC in the SWDAs (lead). If the result exceeds the RG, then a step-out excavation will be performed. If the step-out result does not exceed the RG, then the same soil sample will be analyzed for the other COCs at the SWDA (i.e., PCBs, PAHs, and dioxin/furans). If other COCs exceed their respective RGs, then a step-out excavation will be performed. A minimum of 25 percent of the samples will be analyzed for dioxins/furans, with analyses biased to sampling locations where there is visual confirmation of debris or ash layers that suggest potential dioxin contamination.

If a confirmation sample location is below groundwater or standing water in an open excavation and the pre-excavation soil cores are insufficient, the confirmation survey will be accomplished either using the excavator arm/bucket or by using a cherry picker to place the surveyor over the excavation to drop a pole to the excavation bottom.

Inspection and clearance of the final excavation footprint for waste materials and debris associated with SWDAs will be conducted and documented.

6.2.4 Radiological Characterization

Radiological characterization will be performed in accordance with the RMDP (Appendix E). Soil samples will be collected when the planned extent of excavation is reached.

6.2.5 Low-Level Radioactive Object Management

There is a possibility of encountering LLROs (i.e., discrete radioactive sources) in soil and debris. The goal is to identify LLROs in the excavation prior to moving the soil onto an RSY pad. Areas exhibiting discrete areas of elevated gamma count rate readings will be investigated in accordance with the RMDP (Appendix E). If identified and recovered, LLROs will be packaged and transported per applicable U.S. Department of Transportation regulations and site-specific work instruction to a designated Radioactive Materials Storage Area consistent with the

Memorandum of Understanding between contractors at NSTI. The Navy will be informed of LLROs encountered as soon as practical. Following safe removal of the accessible LLROs, work will resume at the site following approval of the Project/Site Radiation Safety Officer.

6.3 GATEVIEW ARSENIC/TPH AREA GROUNDWATER MONITORING

The Gateview Arsenic/TPH Area in IR Site 12 (Figure 5) is contaminated by TPH (free product and dissolved phases) in soil and groundwater and dissolved arsenic in groundwater. The TPH in soil and groundwater at the Gateview Arsenic/TPH Area is located with, and is believed to contribute to, the elevated concentrations of dissolved arsenic in groundwater. Mass reduction of TPH in soil was conducted in 2017 per the *Work Plan Time Critical Removal Action Installation Restoration Site 12* (CE2Kleinfelder, 2016). The current phase of work addresses groundwater only.

Groundwater monitoring will be performed in accordance with the *Final Interim Groundwater Monitoring Plan, Naval Station Treasure Island, San Francisco, California* (PRC Environmental Management, Inc., 1997) at installed wells in the Gateview Arsenic/TPH Area. Groundwater elevation and sampling data will be collected in accordance with SAP Worksheet #14. Groundwater samples will be collected and analyzed in accordance with SAP (Appendix A) Worksheets #17 and #18. TPH concentrations and monitored natural attenuation (MNA) parameters in groundwater will be evaluated against the criteria presented in the SAP (Appendix A) Worksheet # 15.15 through 15.18.

6.3.1 Groundwater Elevation Measurement

Prior to sampling the monitoring wells, depth to groundwater will be measured using an electronic water level meter. Depth-to-groundwater measurements along with monitoring well elevations will be used to calculate groundwater elevation, flow direction, and gradient.

6.3.2 Groundwater Sampling

Groundwater samples will be collected using low-flow (minimal drawdown) purging and sampling methodology, as described in the NOREAS Field SOP FS-101 provided in Attachment A of the SAP (Appendix A). Monitoring wells will be purged using bladder pumps. For wells that have diameters smaller than 0.75 inches, a peristaltic pump with new or dedicated tubing will be used for purging and sampling. Additional information regarding groundwater sampling locations, sampling frequency, sampling procedures, and analytical requirements are summarized in SAP Worksheet #14 (Appendix A). Inspections to be conducted during the site remediation of IR Site 12 are described in the CQCP (Appendix D).

6.3.3 Quality Control Samples

Along with the primary groundwater and soil samples, field quality control (QC) samples will be collected during monitoring activities. Field QC samples will include duplicate samples, equipment rinsate samples, source-water blanks, and trip blanks, as described in the SAP (Appendix A).

6.3.4 Groundwater QC Samples

Field duplicate samples will be collected during groundwater sampling. Duplicate samples will be collected at a rate of 10 percent of the total number of primary samples and will be analyzed for the same parameters as the corresponding primary sample. During groundwater sampling, duplicate samples will be collected at the same time as the primary sample by collecting additional containers, as described in SAP Worksheets #19 and #20 (Appendix A).

Equipment rinsate samples will be collected from all non-dedicated sampling equipment at a rate of one sample per day of sampling. Each equipment rinsate will consist of analyte-free, reagent grade water collected from a final rinse of sampling equipment after the decontamination procedure has been performed. The purpose of the equipment rinsate is to evaluate the effectiveness of the decontamination procedure and potential for cross-contamination during sampling collection.

Along with the equipment rinsate samples, a source-water blank sample will be collected. A source-water blank sample will consist of analyte-free, reagent-grade water provided by the laboratory for use as the final rinse step in the decontamination process. Source-water blank samples are used to verify whether the water used for the equipment final rinse might be contributing to the analytes detected in the primary samples.

Trip blank samples will accompany groundwater samples to the laboratory. Trip blanks will consist of three 40-milliliter glass vials filled with analyte-free, reagent-grade water provided by the laboratory that will be placed in each of the coolers containing samples to be analyzed for VOCs. The purpose of the trip blank sample is to assess the potential for the primary samples to be contaminated from outside sources during transport or to assess if cross-contamination potentially occurred between the samples during shipping.

7.0 FIELD CLOSE-OUT ACTIVITIES

This section describes the activities to be performed upon completion of the site work including, site restoration, inspections, demobilization, and monitoring efforts.

7.1 SITE RESTORATION

Any utilities disturbed by the excavation activities will be replaced, capped, and/or repaired. Excavations will be backfilled to match the existing grade using imported fill material; and the fill compacted based on the planned use of each area once confirmation sampling criteria have been met.

For excavations in which groundwater is present, with Navy concurrence, radiologically cleared recycle fill materials (recycled concrete from demolished building foundations reduced to less than 12 inches diameter for reuse) and/or crushed rock/gravel will be placed as bridging material to approximately 3-5 feet bgs (depending on water level). A geotextile fabric (or equivalent) will be placed over the bridging material.

For excavations where groundwater is not present, or where bridging material has been used, backfilling will proceed using uncontaminated fill material meeting the *Information Advisory: Clean Imported Fill Material* (California Department of Toxic Substances Control, 2001) criteria. The fill material will be placed in the excavation area in 18-inch lifts and compacted as required based on site restoration requirements specific to each location. Where appropriate, disturbed areas will be revegetated with the dominant native plant species observed at the location prior to initiating the excavation.

If existing roadways need repair, aggregate base may be utilized under the re-constructed roadways. AB will be placed in 8-inch maximum lifts. Compaction will meet 95 percent maximum dry density.

At the completion of construction activities at the SWDAs, the RSY pads will be demobilized and the SWDAs will be restored "in-kind" to grade and conditions equal to original conditions, unless noted otherwise.

For open areas previously covered with grass, an appropriate grass seed mix will be applied by hydro seeding or similar means to restore the area to compatible neighboring grasses. The seed mix will be consistent with those used previously at NSTI and will submitted to the Navy for concurrence prior to application.

7.2 INSPECTIONS

Inspections will be conducted as described in the CQCP (Appendix D).

7.3 DEMOBILIZATION

Earthwork equipment and personnel will be demobilized as activities are completed. Radiological surveys will be performed of vehicles and equipment prior to their release from the project. Low level radioactive waste (LLRW) and mixed waste will be transferred to the Navy's LLRW basewide contractor. Demobilization will include the disposition of government-owned property, if any; decontamination and removal of equipment, tools, and supplies; removal of temporary fencing, traffic control devices, signs, storage containers, portable toilets, and refuse containers. Office and storage trailers will be disconnected from utilities, removed, and returned to the rental company. The equipment storage and laydown areas will be inspected to verify that project-related equipment, trash, and debris have been collected and properly disposed. A final site inspection will be held by the Navy, Gilbane, and other stakeholders as may be required.

8.0 REMEDIAL ACTION COMPLETION REPORT

After the final inspection, Gilbane will prepare a RACR that describes in detail the IR Site 12 non-SWDA remedial action. The RACR will become the primary reference document for demonstrating remediation of all chemical contamination within IR Site 12 non-SWDAs has been completed. The RACR will be certified by an authorized Navy representative. This document will be provided to the Navy in preliminary (internal) draft form for initial review, followed by draft, draft final, and final versions for review and comments. The draft final version will incorporate resolved regulatory agency comments.

The RACR will include at a minimum, the following items:

- Site conditions and background
- Summary of work defined in the work plan and certification of the work performed
- Historical removal action activities
- Remedial Action construction activities
- Explanation of modifications and/or field change requests
- Construction monitoring and excavation confirmation testing results
- Description of site conditions and delineated excavations prior to backfill
- Surveying and site restoration
- Demonstration of completion
- Community involvement
- Certification statement
- Conclusions and recommendations
- Data tables
- Radiological screening and systematic sampling data packages capable of supporting characterization surveys
- Munitions oversight/screening, if performed
- Figures
- References
- Appendices

The appendices will include, but are not limited to, the Record Drawings (survey), photographs, waste manifests, field sampling logs, laboratory analytical results, data validation reports, permits, certificates of disposal/destruction/recycling, and response to agency comments on the draft report. The Contractor will provide a copy of all load tickets for construction material including import backfill soil and waste disposal in the contract closeout report.

Data packages containing detailed sample results will be prepared as the project progresses and will be submitted to the Navy for review and concurrence. The data packages will be prepared as "stand-alone" packages to allow independent review and verification of results. If desired, a summary letter and CD containing the detailed results can be provided to interested stakeholders (e.g., DTSC, CDPH, and/or the Water Board).

Two types of data packages will be prepared. A post-remedial action data package will be prepared for each excavation site that includes post-excavation data from the "as-left" excavation floor and wall surfaces. Waste characterization data packages will be prepared for demolition debris from each building and for each laydown pad of excavated soil. The package will demonstrate suitability of the waste for disposal as LLRW or as non-radioactively contaminated waste. Concurrence from the Navy will be obtained prior to transport of the material off-island to an approved disposal facility.

Tabular and spatial data and environmental restoration program documentation will be submitted to the Naval Installation Restoration Information Solution (NIRIS) system and documented within the RACR. Analytical data generated by the laboratory will be reviewed by the Project Chemist and validated in accordance with the SAP, prior to submittal to NIRIS. NIRIS data submittals will be coordinated with the Command NIRIS Regional Data Manager (RDM) for inclusion into NIRIS. Relevant environmental tabular data will be submitted, including confirmation sampling results, using the NIRIS Electronic Data Deliverable (NEDD) format as outlined in the current NEDD SOP. Appropriate NEDD tables will be identified to populate and approval will be obtained from the Navy RPM to ensure completeness. Stockpile sampling results and waste water sampling results used to classify excavated soil and waste water for disposal purposes are not required to be and will not be submitted to NIRIS. Spatial information will be submitted in accordance with current Non-NEDD Deliverable Submittal Guidelines.

Groundwater monitoring will be reported in stand-alone reports while the follow on work for the NTCRA excavation will be documented as an appendix to the RACR.

9.0 REFERENCES

Argonne National Laboratory (ANL), 2016. RESRAD-ONSITE for Windows, Version 7.2. July.

Bay Area Air Quality Management District (BAAQMD), 2007, Regulation 6, Particulate Matter, Rule 1, General Requirements, 305, Visible Particles, San Francisco, California, December 5 <http://www.baaqmd.gov/dst/regulations/>.

CB&I Federal Services, LLC (CB&I), 2015. *Final Work Plan for Non-Time Critical Removal Action for Solid Waste Disposal Areas Westside, Bayside, and North point, Radiological Characterization, Building Demolition, and Remediation, Installation Restoration Site 12 (Phase III), Former Naval Station Treasure Island, San Francisco, California*. May.

City and County of San Francisco (CCSF). 1996. "*Naval Station Treasure Island Reuse Plan – Public Review Draft*". Prepared for Office of Military Base Conversion, Planning Department, CCSF, and the San Francisco Redevelopment Agency. June 6.

CCSF. 2011. "*Treasure Island/Yerba Buena Island Redevelopment Project Final Environmental Impact Report*". Planning Department. April.

California Department of Toxic Substances Control (DTSC), 2001. *Information Advisory, Clean Imported Fill Material.* October.

DoD et al (U.S. Department of Defense , U. S. Department of Energy, U. S. Nuclear Regulatory Commission [NRC], and U. S. Environmental Protection Agency [EPA]), 2000. *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*. August (NUREG-1575).

EPA, 2014. OSWER Directive 9200.4-40, *Radiation Risk Assessment at CERCLA Sites: Q&A*. EPA 540-R-012-13. May.

Gilbane, 2018. *Health and Safety Plan includes Accident Prevention Plan, Installation Restoration Site 12 Remedial Action*. TBD.

PRC Environmental Management, Inc, 1997. *Final Interim Groundwater Monitoring Plan, Naval Station Treasure Island, San Francisco, California*. September.

San Francisco Regional Water Quality Control Board, 2007. *San Francisco Bay Basin (Region 2) Water Quality Control Plan.*

Shaw Environmental, Inc. (Shaw), 2012. *Analysis of Gamma Survey and Radium-226 Soil Concentration Data at the Treasure Island Site-Wide Background Areas and the Area 7 Background Reference Area*. Memorandum dated April 23, 2012.

TriEco-Tt. 2012. "*Final Remedial Investigation Report for Installation Restoration Site 12, Old Bunker Area, Naval Station Treasure Island, San Francisco, California*." June.

United States Department of the Navy (Navy). 1987. *Draft Environmental Impact Statement for Battleship/Battlegroup/Cruiser Destroyer Group Homeporting, San Francisco, California*.

Navy, 2007. *Action Memorandum/Interim Remedial Action Plan: Non-Time Critical Removal Action for Solid Waste Disposal Areas Installation Restoration Site 12 Old Bunker Area Naval Station Treasure Island San Francisco, California*. February 15.

Navy, 2017. *Final Record of Decision/Final Remedial Action Plan for Installation Restoration Site 12 (Non-Solid Waste Disposal Areas and Non-Radiological) Former Naval Station Treasure Island San Francisco, California*. March.

NRC, 1981. *Radiation Safety Surveys at Medical Institutions*. Regulatory Guide 8.23. January.

FIGURES

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IR Site 12 Non-SWDA Remedial Action/
SWDA Removal Action
Former Naval Station Treasure Island
San Francisco, CA

Figure 1
Treasure Island Location Map

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NAVFAC Naval Facilities Engineering Command

IR Site 12 Non-SWDA Remedial Action/
SWDA Removal Action
Former Naval Station Treasure Island
San Francisco, CA

Figure 2
IR Site 12
Non-SWDA Remedial Action Map

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IR Site 12 Non-SWDA Remedial Action/ SWDA Removal Action
Former Naval Station Treasure Island
San Francisco, CA

Figure 3
IR Site 12 North Point
SWDA NTCRA Map

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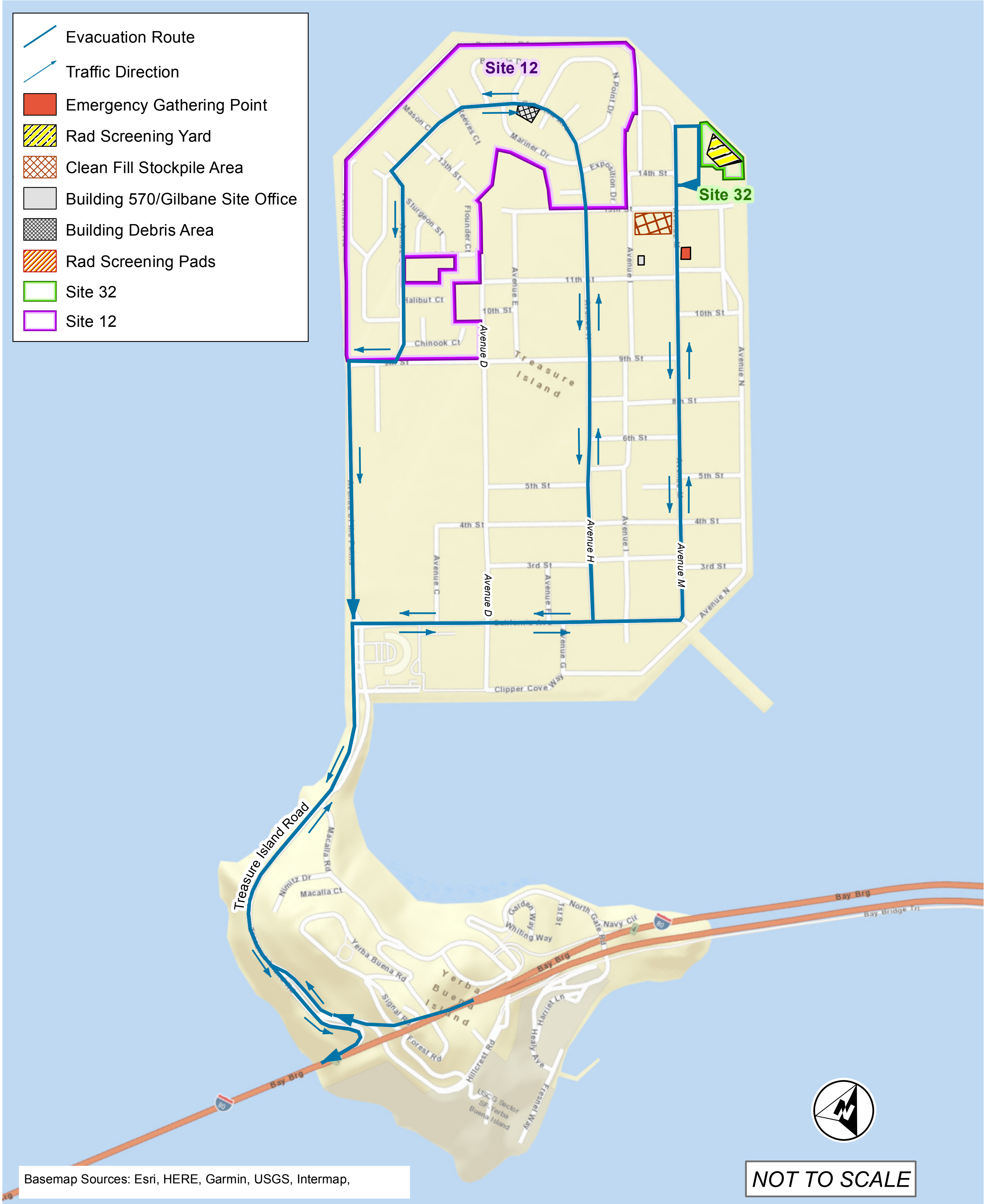

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Naval Facilities Engineering Command

IR Site 12 Non-SWDA Remedial Action/
SWDA Removal Action
Former Naval Station Treasure Island
San Francisco, CA

Figure 4
IR Site 12
Truck Route Map

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IR Site 12 Non-SWDA Remedial Action/
SWDA Removal Action
Former Naval Station Treasure Island
San Francisco, CA

Figure 5
Gateview Arsenic/TPH Area
Groundwater Monitoring Well Map

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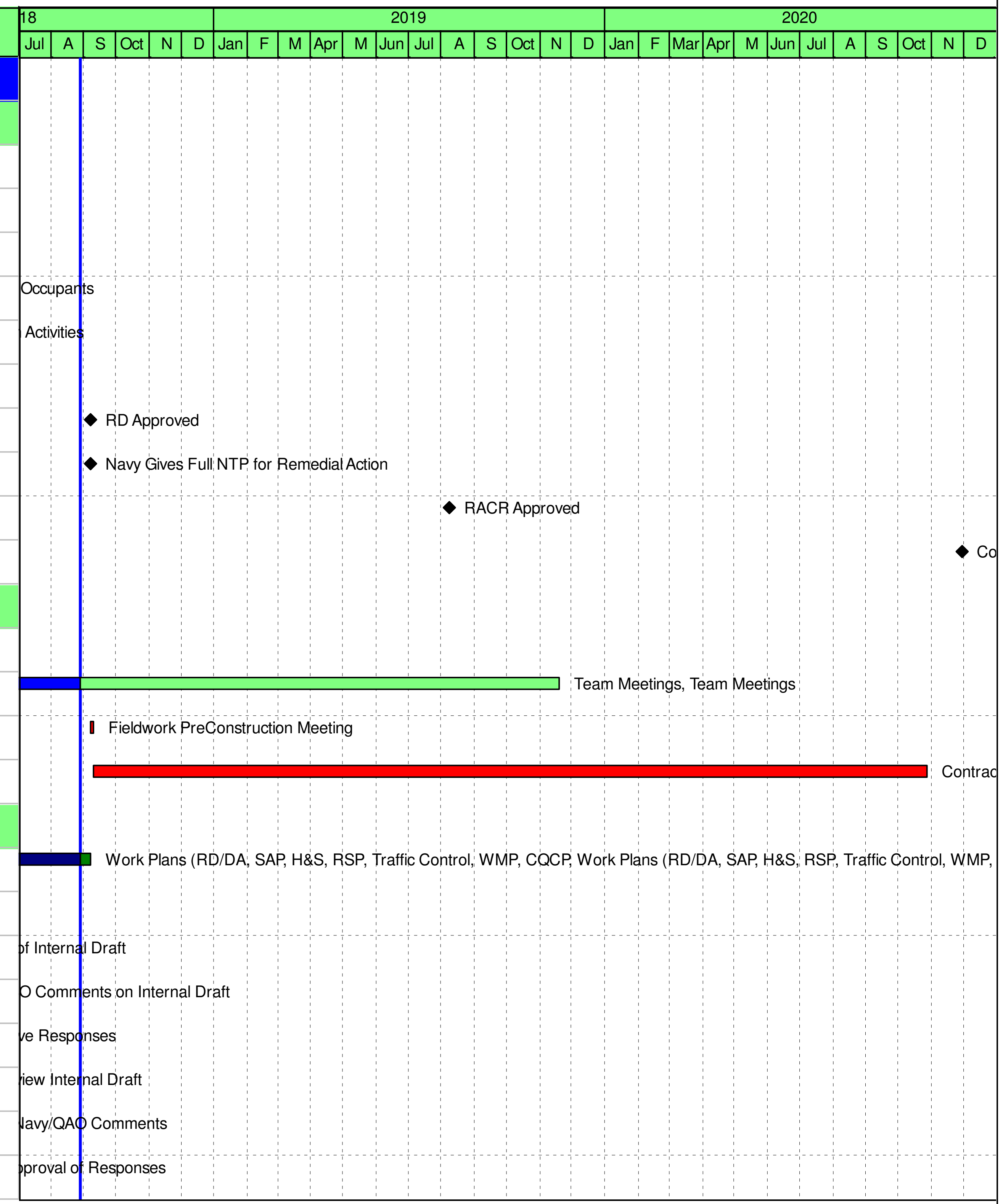
Figure 6 Project Schedule

Data Date - 29-Aug-18 Run Date - 29-Aug-18

Activity ID	Activity Name	Orig Dur	Activity % Complete	Start	Finish	Predecessors
RADMAC II - Treasure Island		1155		02-Aug-17 A	30-Nov-20	
Milestones		788		02-Aug-17 A	30-Nov-20	
MS0100	Contract Award	0	100%	02-Aug-17 A		
MS0200	Submit Schedule and Agenda	0	100%	15-Aug-17 A		MS0100
MS0300	Kick-off Meeting	0	100%	15-Aug-17 A		MS0100
MS0400	Navy Gives 90-Day Notice to Bldg 1126 & 1217 Occupants	0	100%	15-Aug-17 A		MS0300
MS0500	Navy Gives Limited NTP for PreRemedial Action Activities	0	100%	15-Aug-17 A		MS0300
MS0600	Award of IDIQ Items	0	100%	22-Sep-17 A		
MS0700	RD Approved	0	0%	07-Sep-18*		PP0180
MS0800	Navy Gives Full NTP for Remedial Action	0	0%	07-Sep-18		MS0700
MS0900	RACR Approved	0	0%	09-Aug-19		RC0170
MS1000	Contractural POP Date	0	0%		30-Nov-20*	RC0170
Project Management		675		15-Aug-17 A	28-Oct-20	
PM0100	Contract Kick-off Meeting	1	100%	15-Aug-17 A	15-Aug-17 A	MS0300
PM0200	Team Meetings	534	42.7%	15-Aug-17 A	19-Nov-19	PM0100
PM0300	Fieldwork PreConstruction Meeting	1	0%	07-Sep-18*	10-Sep-18	MS0700
PM0400	Contractor QC Meetings	534	0%	10-Sep-18*	28-Oct-20	PM0300
Project Plans		896		15-Aug-17 A	07-Sep-18	
PP0100	Work Plans (RD/DA, SAP, H&S, RSP, Traffic Control, WMP, CQCP	534	98.84%	15-Aug-17 A	07-Sep-18	PP0110
PP0110	Internal Draft	35	100%	15-Aug-17 A	24-Oct-17 A	
PP0120	Navy/BRAC/RASO Review of Internal Draft	30	100%	25-Oct-17 A	18-Dec-17 A	PP0110
PP0125	Response to BRAC/RASO Comments on Internal Draft	25	100%	14-Dec-17 A	07-Jan-18 A	PP0120
PP0126	BRAC/RASO Approve Responses	30	100%	07-Jan-18 A	08-Feb-18 A	PP0125
PP0127	Navy/QAO Review Internal Draft	30	100%	09-Feb-18 A	14-Mar-18 A	PP0126
PP0128	Response to Navy/QAO Comments	5	100%	14-Mar-18 A	19-Mar-18 A	PP0127
PP0129	Navy/QAO Approval of Responses	5	100%	20-Mar-18 A	26-Mar-18 A	PP0128



- Remaining Level of Effort
- Actual Level of Effort
- Actual Work
- Remaining Work
- Critical Remaining Work
- ◆ Milestone

RADMAC II - IR 12 - Treasure Island
August 2018 Schedule

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Figure 6 Project Schedule

Activity ID	Activity Name	Orig Dur	Activity % Complete	Start	Finish	Predecessors
PP0130	Preparation of Draft	5	100%	27-Mar-18 A	04-Apr-18 A	PP0120, PP0129
PP0140	Navy Review of Draft (Not Required)	0	100%	05-Apr-18 A	05-Apr-18 A	PP0130
PP0150	Regulatory Review of Draft	30	100%	05-Apr-18 A	08-Jun-18 A	PP0140
PP0160	Draft Final and RTC's	21	99%	11-Jun-18 A	29-Aug-18	PP0150
PP0170	Navy Review of Draft Final	5	0%	29-Aug-18	06-Sep-18	PP0160
PP0180	Submit Final	1	0%	06-Sep-18	07-Sep-18	PP0170, PP0100
Remedial Action Implementation		107		13-Aug-18 A	06-Feb-19	
Pre-Remedial Actions		11		23-Aug-18 A	24-Sep-18	
PRE0100	Issue First Work Notice	1	0%	23-Aug-18 A	10-Sep-18	MS0700
PRE0200	Secure Buildings 1126 &1217 (Not Required)	10	0%	10-Sep-18	24-Sep-18	PRE0100
Mobilization		14		13-Aug-18 A	19-Sep-18	
MM0100	Mobilization and Set-up	12	0%	13-Aug-18 A	17-Sep-18	
MM0140	Mobilize Trailers and Equipment	4	0%	27-Aug-18 A	13-Sep-18	PRE0100
MM0110	USA Survey	3	0%	07-Sep-18	12-Sep-18	PRE0100, MM0100
MM0120	Disconnect Utilities	1	0%	07-Sep-18	10-Sep-18	PRE0100
MM0150	Establish Laydown Area and	4	0%	07-Sep-18	13-Sep-18	PRE0100
MM0130	Conduct Civil Site Survey	3	0%	10-Sep-18	13-Sep-18	PRE0100
MM0170	Install Site Security and Fences	5	0%	10-Sep-18	17-Sep-18	PRE0100
MM0160	Establish Radiological Screening (RSA's)	4	0%	13-Sep-18	19-Sep-18	MM0150
MM0180	Install BMP's and Dust Control	2	0%	13-Sep-18	17-Sep-18	MM0150, MM0100
Remedial Action		75		04-Sep-18	24-Dec-18	
RA0140	Bldg 1126 - Radiological Survey	3	0%	04-Sep-18*	06-Sep-18	MM0100
RA0180	Bldg 1217 - Radiological Survey	3	0%	04-Sep-18*	06-Sep-18	MM0100
RA0150	Bldg 1126 - Remove ACM	7	0%	11-Sep-18*	19-Sep-18	RA0140
RA0100	Conduct 40 Discreet Excavations	30	0%	19-Sep-18	01-Nov-18	MM0180, MM0160
RA0120	Backfill 40 Discreet Excavations	30	0%	19-Sep-18	01-Nov-18	RA0100
RA0130	Bldg 1126 - Remove Appliances/Recyclable Material	2	0%	19-Sep-18	21-Sep-18	RA0100

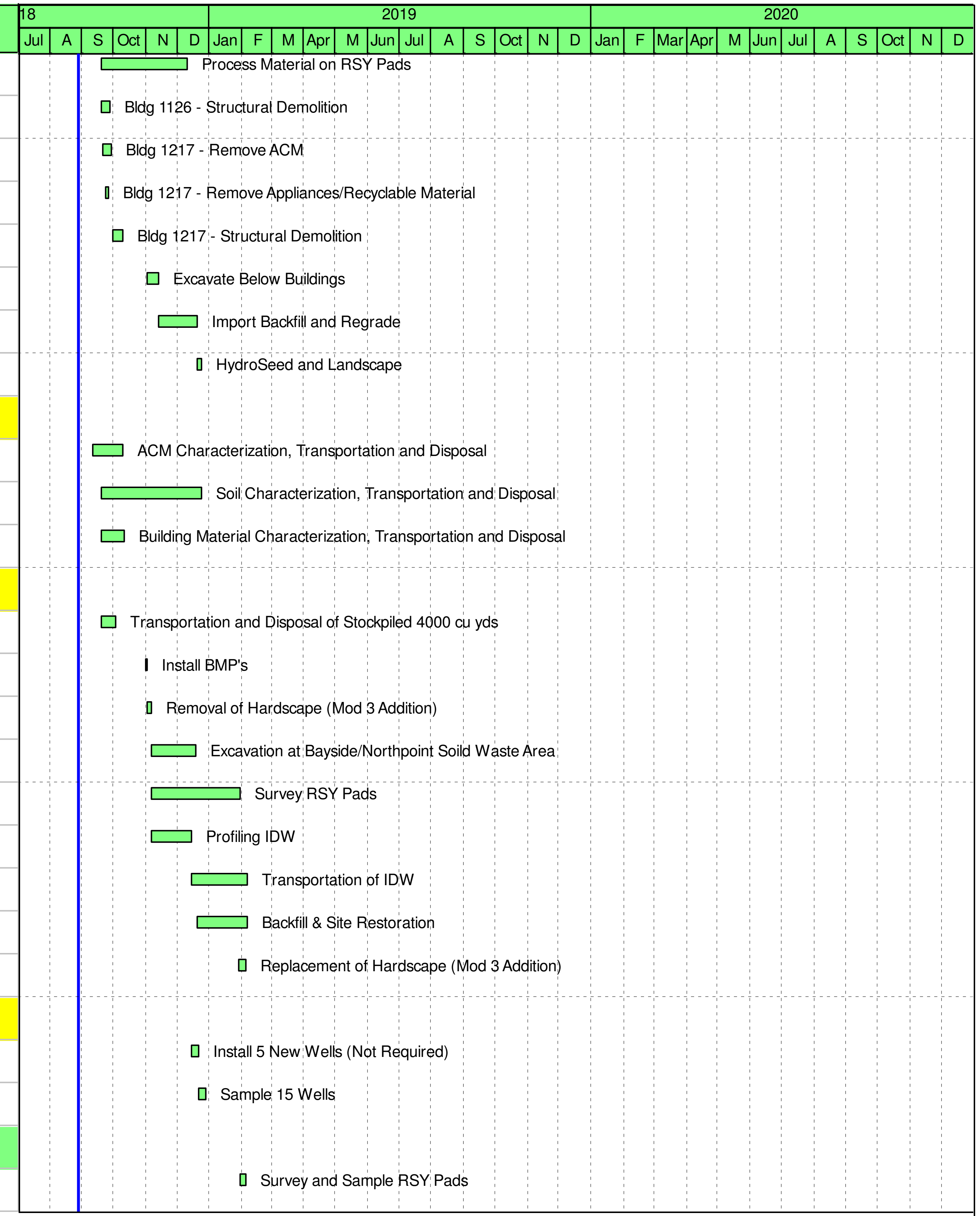
Remaining Level of Effort ◆ ◆ Milestone
Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work

RADMAC II - IR 12 - Treasure Island
August 2018 Schedule

Gilbane

Figure 6 Project Schedule

Activity ID	Activity Name	Orig Dur	Activity % Complete	Start	Finish	Predecessors
RA0220	Process Material on RSY Pads	55	0%	19-Sep-18	11-Dec-18	RA0100
RA0160	Bldg 1126 - Structural Demolition	6	0%	20-Sep-18	27-Sep-18	RA0150
RA0190	Bldg 1217 - Remove ACM	6	0%	21-Sep-18	28-Sep-18	RA0150
RA0170	Bldg 1217 - Remove Appliances/Recyclable Material	2	0%	24-Sep-18	26-Sep-18	RA0130
RA0200	Bldg 1217 - Structural Demolition	6	0%	01-Oct-18	09-Oct-18	RA0160
RA0210	Excavate Below Buildings	6	0%	02-Nov-18	13-Nov-18	RA0100, RA0200
RA0230	Import Backfill and Regrade	25	0%	13-Nov-18	20-Dec-18	RA0210
RA0240	HydroSeed and Landscape	2	0%	20-Dec-18	24-Dec-18	RA0230
Waste Characterization, Transportation and Disposal		70		11-Sep-18	24-Dec-18	
RA0270	ACM Characterization, Transportation and Disposal	20	0%	11-Sep-18	10-Oct-18	RA0150
RA0250	Soil Characterization, Transportation and Disposal	64	0%	19-Sep-18	24-Dec-18	RA0100
RA0260	Building Material Characterization, Transportation and Disposal	15	0%	20-Sep-18	11-Oct-18	RA0160, RA0200
Continuation of NTCRA Field Activities		92		20-Sep-18	06-Feb-19	
RA0280	Transportation and Disposal of Stockpiled 4000 cu yds	10	0%	20-Sep-18	03-Oct-18	RA0160
RA0290	Install BMP's	1	0%	01-Nov-18	02-Nov-18	RA0100
RA0295	Removal of Hardscape (Mod 3 Addition)	2	0%	02-Nov-18	06-Nov-18	RA0290
RA0300	Excavation at Bayside/Northpoint Soild Waste Area	28	0%	06-Nov-18	19-Dec-18	RA0295
RA0310	Survey RSY Pads	55	0%	06-Nov-18	30-Jan-19	RA0300
RA0340	Profiling IDW	25	0%	06-Nov-18	14-Dec-18	RA0300
RA0350	Transportation of IDW	35	0%	14-Dec-18	06-Feb-19	RA0340
RA0320	Backfill & Site Restoration	31	0%	20-Dec-18	06-Feb-19	RA0300
RA0330	Replacement of Hardscape (Mod 3 Addition)	5	0%	29-Jan-19	05-Feb-19	RA0320
GW Monitoring Wells at Gateway Arsenic		9		14-Dec-18	28-Dec-18	
GW0100	Install 5 New Wells (Not Required)	5	0%	14-Dec-18	21-Dec-18	RA0350
GW0200	Sample 15 Wells	4	0%	21-Dec-18	28-Dec-18	GW0100
Demobilization and Close-out		17		30-Jan-19	25-Feb-19	
DM0100	Survey and Sample RSY Pads	4	0%	30-Jan-19	05-Feb-19	RA0310

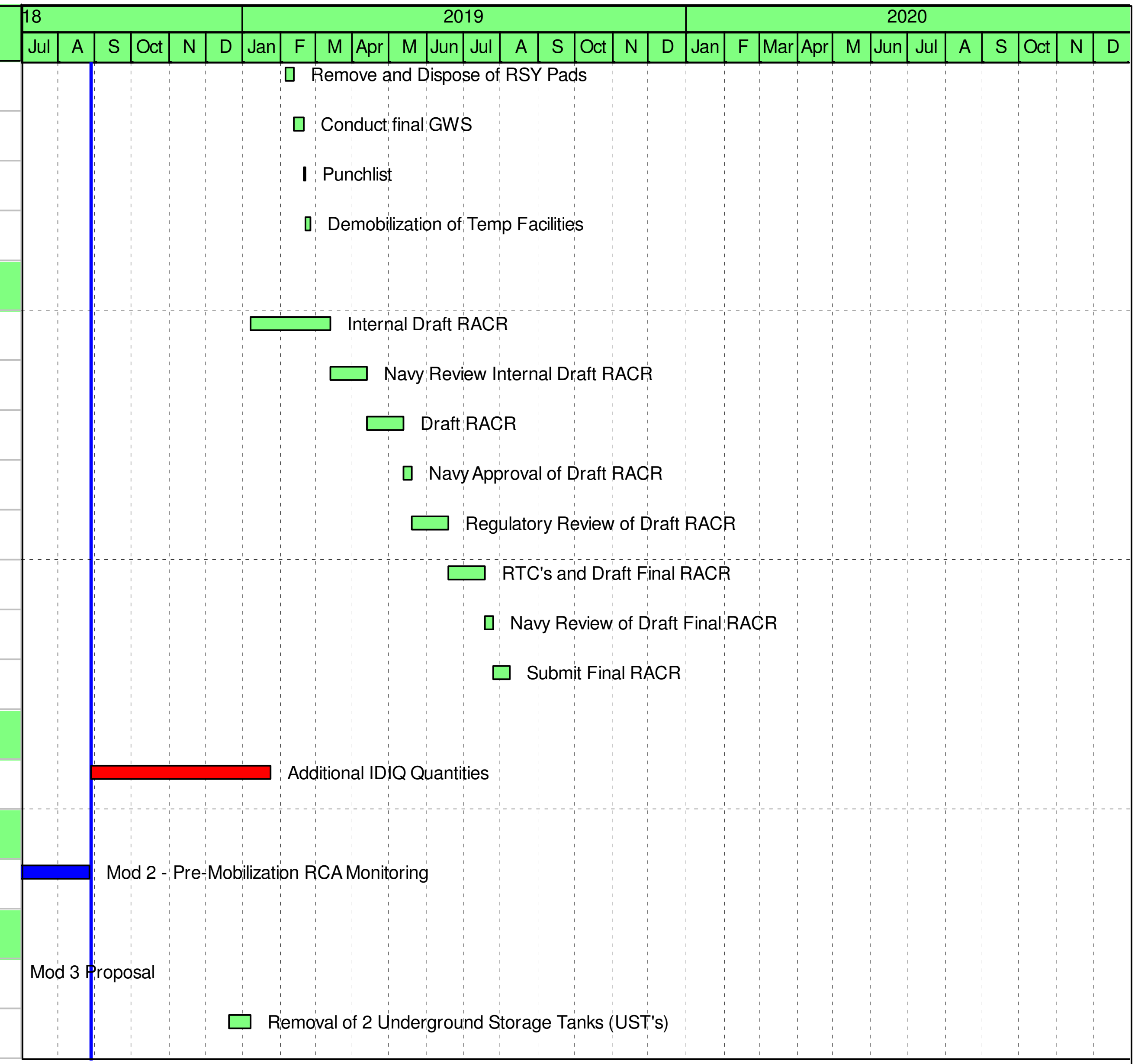


Remaining Level of Effort
Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work
◆ Milestone

RADMAC II - IR 12 - Treasure Island
August 2018 Schedule

Figure 6 Project Schedule

Activity ID	Activity Name	Orig Dur	Activity % Complete	Start	Finish	Predecessors
DM0110	Remove and Dispose of RSY Pads	5	0%	05-Feb-19	12-Feb-19	DM0100
DM0120	Conduct final GWS	4	0%	12-Feb-19	19-Feb-19	DM0110
DM0130	Punchlist	2	0%	19-Feb-19	21-Feb-19	DM0120
DM0140	Demobilization of Temp Facilities	2	0%	21-Feb-19	25-Feb-19	DM0130
Reports and Data Submission		214		07-Jan-19	09-Aug-19	
RC0100	Internal Draft RACR	45	0%	07-Jan-19	13-Mar-19	RA0240, MOD3 100
RC0110	Navy Review Internal Draft RACR	30	0%	13-Mar-19	12-Apr-19	RC0100
RC0120	Draft RACR	21	0%	12-Apr-19	13-May-19	RC0110
RC0130	Navy Approval of Draft RACR	5	0%	13-May-19	20-May-19	RC0120
RC0140	Regulatory Review of Draft RACR	30	0%	20-May-19	19-Jun-19	RC0130
RC0150	RTC's and Draft Final RACR	21	0%	19-Jun-19	19-Jul-19	RC0140
RC0160	Navy Review of Draft Final RACR	5	0%	19-Jul-19	26-Jul-19	RC0150
RC0170	Submit Final RACR	10	0%	26-Jul-19	09-Aug-19	RC0160
MOD 1 - Additional IDIQ Quantities		98		29-Aug-18	23-Jan-19	
IDIQ0010	Additional IDIQ Quantities	98	0%	29-Aug-18*	23-Jan-19	
MOD 2 - Early Establishment of RCA Monitoring		40		19-Mar-18 A	27-Aug-18 A	
MOD2 001	Mod 2 - Pre-Mobilization RCA Monitoring	40	100%	19-Mar-18 A	27-Aug-18 A	
MOD 3 - Removal of 2 UST's		201		01-May-18 A	07-Jan-19	
MOD3 001	Mod 3 Proposal	40	100%	01-May-18 A	25-Jun-18 A	
MOD3 100	Removal of 2 Underground Storage Tanks (UST's)	10	0%	20-Dec-18	07-Jan-19	MOD3 001, RA0230



Remaining Level of Effort ◆ ◆ Milestone
Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work

RADMAC II - IR 12 - Treasure Island
August 2018 Schedule
4 of 4

Gilbane

APPENDICES

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APPENDIX A

SAMPLING AND ANALYSIS PLAN
(FIELD SAMPLING PLAN AND
QUALITY ASSURANCE PROJECT PLAN)

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SAP Worksheet #1 – Title and Approval Page

FINAL
SAMPLING AND ANALYSIS PLAN
(Field Sampling Plan and Quality Assurance Project Plan)
Remedial Action/Non-Time Critical Removal Action Installation Restoration Site 12 - Former Naval Station Treasure Island, San Francisco, California
September 2018

Prepared for:
Base Realignment and Closure Program Management Office - West
33000 Nixie Way, Building 50
San Diego, California 92147

Prepared by:
Gilbane Federal
1655 Grant Street, Suite 1200
Concord, CA 94520
(925) 946-3100

Document Control Number: GLBN-0005- 4239-0011

Prepared under:
Contract Number N62473-17-D-0005
Contract Task Order CTO N6247317F4239

Reviewed by: Kristen Carlyon Peyton 9/13/18
Kristen Carlyon Peyton — Date
Program Chemist, Gilbane

Reviewed by: Laura Tryboski 9.13.2018
Laura Tryboski — Date
Quality Assurance Program Manager, Gilbane

Approved by: WALKER.TERESIE.R.1515870071
Digitally signed by WALKER.TERESIE.R.1515870071
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USN, cn=WALKER.TERESIE.R.1515870071
Date: 2018.09.13 16:14:17 -04'00'

Joseph Arlauskas — Date
Quality Assurance Officer
U.S. Navy, NAVFAC SW

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EXECUTIVE SUMMARY

INTRODUCTION

This Sampling and Analysis Plan (SAP) provides guidance to Gilbane Federal (Gilbane) and its project subcontractors in the performance of sampling and analysis to perform remedial action (RA) activities to be performed in the non-Solid Waste Disposal Areas (SWDA) within Installation Restoration (IR) Site 12 (Old Bunker Area) and to continue the Site 12 non-time critical removal action (NTCRA) at the Northpoint SWDA at the former Naval Station Treasure Island (NSTI) in San Francisco, California (Figure 1). Groundwater monitoring in the Gateview Arsenic/Total Petroleum Hydrocarbon (TPH) Area that is within IR Site 12 will also be performed. This SAP was prepared by Gilbane, as requested by the United States Department of the Navy (Navy) under the Radiological Multiple Award Contract (RADMAC II) Number N62473-17-D-0005, Contract Task Order (CTO) F4239, based on the Performance Work Statement (PWS) received from the Navy on March 22, 2017.

IR Site 12 contains soil and groundwater with elevated concentration of the following chemicals of concern (COCs).

- Soil
  - Lead
  - Polycyclic aromatic hydrocarbons (PAHs) as benzo(a)pyrene equivalents (BaP EQ)
  - Polychlorinated biphenyls (PCBs) as total Aroclors
  - Dioxins as 2,3,7,8- tetrachlorodibenzo-p-dioxin toxicity equivalent (TCDD TEQ)
- Groundwater
  - Arsenic
- Radium 226 (Ra-226) (applicable to both matrices)

As stated in the Final Record of Decision/Final Remedial Action Plan for Installation Restoration Site 12 (Non-Solid Waste Disposal Areas and Non-Radiological) Former Naval Station Treasure Island San Francisco, California (IR Site 12 Non-SWDA/Non-Radiological ROD; Navy, 2017), the Navy will address other chemical in soil, although these chemicals were not identified as COCs in the human health or ecological risk assessments. The Navy has identified remediation goals for pesticides and chromium. The other chemicals being addressed in soil are as follows:

  - Total Chromium
  - Pesticides (4,4-dichlorodiphenyldichloroethane [4,4-DDD] and alpha-benzene hexachloride [alpha-BHC]

The intent of this remedial action/NTRCA is to complete the work to support no further action for COCs in the IR Site 12 non-SWDAs and the North Point SWDA as described in the following documents:

- IR Site 12 Non-SWDA/Non Radiological ROD (Navy, 2017)
- *Action Memorandum/Interim Remedial Action Plan: Non-Time Critical Removal Action for Solid Waste Disposal Areas, Installation Restoration Site 12, Old Bunker Area* (Navy, 2007).

The remedial/removal action objectives (RAOs) are to reduce risk to current and future residents by minimizing the dermal contact, incidental ingestion, and inhalation with soil containing known COCs. The RAOs will be achieved by excavating discrete locations of soil with COCs above the remediation goals (RGs) and disposing of the soil off-site. This includes confirming that Ra-226 soil concentrations are below the release criteria. Groundwater monitoring is associated with this project, but achieving the RAOs for groundwater is not a performance objective.

A secondary objective of the IR Site 12 non-SWDA remedial action is to collect radiological data representative of post-remedial action or "as-left" conditions of each excavation to refine the Site 12 conceptual site model (CSM) for non-SWDAs as to the presence and extent of radioactive contamination due to housing construction grading.

This SAP (Appendix A of the Work Plan) addresses critical requirements such as project organization and responsibilities, data quality objectives (DQOs), sampling design, field and analytical procedures, quality control (QC), and quality assurance (QA) for sampling at the former NSTI. The QA/QC elements in this SAP were prepared in accordance with the U.S, Environmental Protection Agency (EPA) Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP; EPA, 2005) and Requirements for Quality Assurance Project Plans, EPA QA/R-5 (EPA, 2006) to ensure that all data collected are precise, accurate, representative, complete, and comparable to meet their intended use.

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SAP Worksheets (Table of Contents)

List of Figures

List of Appendices

Acronyms

°C	degrees Celsius
°F	degrees Fahrenheit
%R	percent recovery
amu	atomic mass unit
AOI	area of interest
BaP	benzo(a)pyrene
bgs	below ground surface
BCT	Base Closure Team
BRAC	Base Realignment and Closure
CA	corrective action
CARB	California Air Resources Board
CAS	Chemical Abstracts Service
CCB	continuing calibration blank
CCSF	City and County of San Francisco
CCV	continuing calibration verification
CDPH	California Department of Public Health
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
CHHSL	California Human Health Screening Level
COC	chain of custody; chemical of concern
CSM	conceptual site model
CSO	Caretaker Site Office
CTO	Contract Task Order
CVAA	cold vapor atomic absorption
CY	cubic yard
D	difference
DER	Duplicate Error Ratio
DL	detection limit
DoD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
DQI	data quality indicator
DQO	data quality objective
DTSC	California Department of Toxic Substances Control
EBS	environmental baseline survey
ECD	electron capture detector
EDD	electronic data deliverable
ELAP	Environmental Laboratory Accreditation Program
EPA	United States Environmental Protection Agency Region 9
EU	exposure unit
EWI	Environmental Work Instruction

FCR	Field Change Request
FID	flame ionization detector
FS	Feasibility Study
g	gram(s)
GC	gas chromatograph
GFPC	gas flow proportional counting
Gilbane	Gilbane Federal
GPS	Global Positioning System
HHRA	Human Health Risk Assessment
HRASTM	Historical Radiological Assessment Supplemental Technical Memorandum
HRGC	high resolution gas chromatography
HRMS	high resolution mass spectrometry
IC	ion chromatography
ICAL	initial calibration
ICB	initial calibration blank
ICP	inductively coupled plasma spectrophotometer
ICP/MS	inductively coupled plasma/mass spectrometer
ICS	interference check solution
ICV	initial calibration verification
IR	Installation Restoration
IS	internal standard
IUPAC	International Union of Pure and Applied Chemistry
keV	kilo-electron volt(s)
L	liter
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LDR	Linear Dynamic Range
LOD	limit of detection
LOQ	limit of quantitation
LRPM	Lead Remedial Project Manager
m	meter(s)
MB	method blank
MDC	minimum detectable concentration
MDL	method detection limit
mg/kg	milligrams per kilogram
mL	milliliters
MS	mass spectrometer
MS/MSD	matrix spike/matrix spike duplicate
msl	mean sea level
NA	not applicable

NAVFAC SW	Naval Facilities Engineering Command Southwest
Navy	United States Department of the Navy
NCR	Nonconformance Report
NEDD	Navy Electronic Data Deliverable
NIRIS	Naval Installation Restoration Information Solution
NSTI	Naval Station Treasure Island
NTCRA	Non-time critical removal action
OSHA	Occupational Safety and Health Organization
OU	Operable Unit
oz.	ounce(s)
PAH	polycyclic aromatic hydrocarbon
PARCC	precision, accuracy, representativeness, completeness, and comparability
PA/SI	preliminary assessment and site inspection
Pb	lead
PCB	polychlorinated biphenyl
pCi/g	picocuries per gram
PM	Project Manager
PMO-W	Program Management Office - West
PPE	personal protective equipment
PQCM	Project Quality Control Manager
PSL	project screening limit
PT	performance testing
PWS	performance work statement
QA	quality assurance
QAO	Quality Assurance Officer
QC	quality control
QCPM	Quality Control Program Manager
QCSR	Quality Control Summary Report
QL	quantitation limit
QSM	Quality Systems Manual
Ra-226	Radium-226
RA	removal action
RAB	Restoration Advisory Board
RACR	Removal Action Completion Report
RADMAC	Radiological Multiple Award Contract
RAO	remedial/removal action objective
RAP	remedial action plan
RASO	Radiological Affairs Support Office
RAWP	Remedial Action Work Plan
RBC	risk-based criteria
RD	Remedial Design
RER	relative error ratio
RG	remediation goal

RI	Remedial Investigation
ROD	record of decision
ROICC	Resident Officer in Charge of Construction
RPD	relative percent difference
RPM	Remedial Project Manager
RSD	relative standard deviation
RSL	regional screening level
RSO	Radiation Safety Officer
RT	retention time
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SDG	sample delivery group
SF	square foot/feet
SLERA	screening-level ecological risk assessment
SOP	standard operating procedure
SSHO	Site Safety and Health Officer
SVOC	semivolatile organic compounds
SWDA	Solid Waste Disposal Area
SWDIV	U.S. Navy, Southwestern Division
TBD	to be determined
TCRA	time-critical removal action
TEQ	toxicity equivalent
TI	Treasure Island
TICD	Treasure Island Community Development
TIDA	Treasure Island Development Authority
TPH	total petroleum hydrocarbons
TPH-e	total petroleum hydrocarbons - extractable
TPH-p	total petroleum hydrocarbons – purgeable
TSA	technical systems audit
TtECI	TetraTech EC, Inc.
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plans
ug/kg	micrograms per kilogram
ug/L	micrograms per liter
UST	underground storage tank
Validata	Validata Chemical Services, Inc.
VOA	volatile organic analysis
VOC	volatile organic compounds
Water Board	San Francisco Bay Regional Water Quality Control Board
WWII	World War II

SAP Worksheet #2 – SAP Identifying Information

Site Name/Number:	**Former Naval Station Treasure Island**
Operable Unit:	**Installation Restoration Site 12**
Contractor Name:	**Gilbane Federal**
Contract Number:	**N62473-17-D-0005**
Contract Title:	**RAD MAC II**
Work Assignment Number (optional):	**CTO F4239**

1. This SAP was prepared in accordance with the requirements of the *Uniform Federal Policy for Quality Assurance Project Plans* (UFP-QAPP; EPA, 2005) and *EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5, QAMS* (EPA, 2002). Additional guidance taken from the following sources:
   - *Quality Systems Manual for Environmental Laboratories, Version 5.1* (QSM; U.S. Department of Defense [DoD], 2017)
   - *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA, 2006)
   - Environmental Work Instruction (EWI) #2, *Review, Approval, Revision, and Amendment of Sampling and Analysis Plans* EV3.2 (NAVFACSW, 2011)

2. Identify regulatory program: Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)

3. This SAP is a: Project-Specific SAP.

4. List dates of scoping sessions that were held:

Scoping/kickoff meeting	8/15/2017

5. List dates and titles of any SAP documents written for previous site work that are relevant to the current investigation.

Title	**Date**
Final Sampling and Analysis Plan Non-Time Critical Removal Action for Bigelow Court Solid Waste Disposal Area, Installation Restoration Site 12, Former Naval Station Treasure Island, San Francisco, California (CB&I)	5/9/2014
Final Sampling and Analysis Plan Non-Time Critical Removal Action, Solid Waste Disposal Areas Westside, Bayside, and North Point, Former Naval Station Treasure Island, San Francisco, California (CB&I)	6/19/2015
Final Sampling and Analysis Plan Time Critical Removal Action Installation Restoration Site 12, Former Naval Station Treasure Island, San Francisco, California (CE2-Kleinfelder)	7/20/2016

6. List organizational partners (stakeholders) and connection with lead organization:
Oversight by the California Department of Toxic Substances Control (DTSC); California Department of Public Health (CDPH), Division of Drinking Water and Environmental Management; the California

Regional Water Quality Control Board-San Francisco Bay Region (Water Board); and the United States Environmental Protection Agency (EPA), and the Treasure Island Development Authority (TIDA)

7. Lead organization:

U.S. Department of the Navy (Navy)

8. If any required SAP elements or required information are not applicable to the project or are provided elsewhere, then note the omitted SAP elements and provide an explanation for their exclusion below:

None

SAP Worksheet #2 – SAP Identifying Information (Continued)

SAP elements and required information that are not applicable to the project.

UFP-QAPP Worksheet #	Required Information	Crosswalk to Related Information
A. Project Management		
Documentation		
1	Title and Approval Page	
2	Table of Contents SAP Identifying Information	
3	Distribution List	
4	Project Personnel Sign-Off Sheet	
Project Organization		
5	Project Organizational Chart	
6	Communication Pathways	
7	Personnel Responsibilities and Qualifications Table	
8	Special Personnel Training Requirements Table	
Project Planning/ Problem Definition		
9	Project Planning Session Documentation (including Data Needs tables) Project Scoping Session Participants Sheet	
10	Problem Definition, Site History, and Background. Site Maps (historical and present)	
11	Site-Specific Project Quality Objectives	
12	Measurement Performance Criteria Table	
13	Sources of Secondary Data and Information Secondary Data Criteria and Limitations Table	
14	Summary of Project Tasks	
15	Reference Limits and Evaluation Table	
16	Project Schedule/Timeline Table	
B. Measurement Data Acquisition		
Sampling Tasks		
17	Sampling Design and Rationale	
18	Sampling Locations and Methods/ SOP Requirements Table Sample Location Map(s)	
19	Analytical Methods/SOP Requirements Table	
20	Field Quality Control Sample Summary Table	
21	Project Sampling SOP References Table Sampling SOPs	
22	Field Equipment Calibration, Maintenance, Testing, and Inspection Table	
Analytical Tasks		
23	Analytical SOPs Analytical SOP References Table	
24	Analytical Instrument Calibration Table	
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	

SAP Worksheet #2 – SAP Identifying Information (Continued)

UFP-QAPP Worksheet #	Required Information	Crosswalk to Related Information
Sample Collection		
26	Sample Handling System, Documentation Collection, Tracking, Archiving and Disposal Sample Handling Flow Diagram	
27	Sample Custody Requirements, Procedures/SOPs Sample Container Identification Example Chain-of-Custody Form and Seal	
Quality Control Samples		
28	QC Samples Table Screening/Confirmatory Analysis Decision Tree	
Data Management Tasks		
29	Project Documents and Records Table	
30	Analytical Services Table Analytical and Data Management SOPs	
C. Assessment Oversight		
31	Planned Project Assessments Table Audit Checklists	
32	Assessment Findings and Corrective Action Responses Table	
33	QA Management Reports Table	
D. Data Review		
34	Verification (Step I) Process Table	
35	Validation (Steps IIa and IIb) Process Table	
36	Validation (Steps IIa and IIb) Summary Table	
37	Usability Assessment	

SAP Worksheet #3 – Distribution List

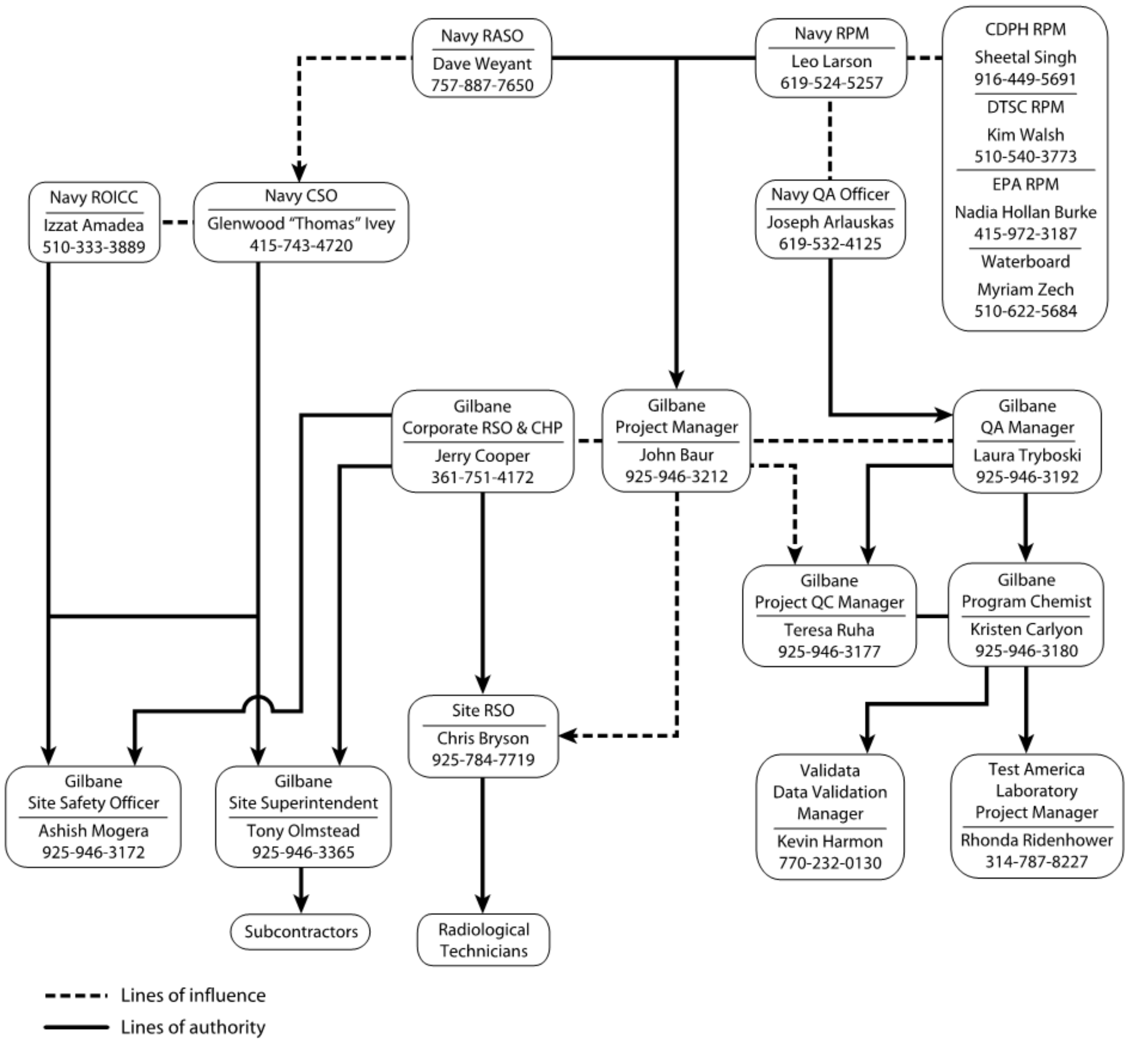
Name of SAP Recipient	Title/Role	Organization	Telephone Number	E-mail Address or Mailing Address
David Clark	Navy Lead Remedial Project Manager (LRPM)	Base Realignment and Closure (BRAC) PMO West	619-524-6870	david.j.clark2@navy.mil
Leo Larson	Navy Remedial Project Manager (RPM)	BRAC PMO West	619-524-5257	llarson@scst.com
Joseph Arlauskas	Navy Quality Assurance Officer (QAO)	NAVFAC SW	619-532-4125	joseph.arlauskas@navy.mil
Dave Weyant	Radiological Technical Manager	Navy Radiological Affairs Support Office (RASO)	757-887-7650	david.weyant@navy.mil
Izzat Amadea	Navy Resident Officer in Charge of Construction (ROICC)	Navy San Francisco Bay Area	510-333-3889	izzat.amadea@navy.mil
Glenwood "Thomas" Ivey	Point of Contact	Navy Caretaker Site Office (CSO)	415-743-4729	glenwood.ivey@navy.mil
Sheetal Singh	Regulatory Agency Representative	CDPH	916-449-5691	sheetal.singh@cdph.ca.gov
Nina Bacey	Regulatory Agency Representative	DTSC	510-540-2480	juanita.bacey@dtsc.ca.gov
Nadia Hollan Burke	Regulatory Agency Representative	EPA	415-972-3187	burke.nadiahollan@epa.gov
Myriam Zech	Regulatory Agency Representative	Water Board	510-622-5684	mzech@waterboards.ca.gov
Robert P. Beck	Treasure Island Director	TIDA	415-274-0662	bob.beck@sfgov.org
John Baur	Project Manager (PM)	Gilbane	925-946-3212	jbaur@gillbaneco.com
Laura Tryboski	Quality Control Program Manager (QCPM)	Gilbane	925-946-3192	ltryboski@gillbaneco.com
Christopher Bryson	Site Radiation Safety Officer (RSO)	Envirachem	925-784-7719	chris.bryson@envirachem.com
Teresa Ruha	Project Quality Control Manager (PQCM)	Gilbane	925-946-3177	truha@gilbaneco.com
Kristen Carlyon Peyton	Program/Project Chemist	Gilbane	925-946-3180	kcarlyon@gillbaneco.com
Tony Olmstead	Site Superintendent	Gilbane	925-946-3365	tolmstead@gilbaneco.com
Ashish Mogera	Site Health & Safety	Gilbane	925-946-3172	amogera@gilbaneco.com

SAP Worksheet #4 – Project Personnel Sign-Off Sheet
(UFP-QAPP Manual Section 2.3.2)

Name	Organization/Title/Role	Telephone Number (optional)	Signature/email receipt	SAP Section Reviewed	Date SAP Read
John Baur	Gilbane/PM	925-946-3212		All	
Chris Bryson	Envirachem/Site RSO	925-784-7719			
Tony Olmstead	Gilbane/Site Superintendent	925-946-3365		All	
Teresa Ruha	Gilbane/PQCM	925-946-3177		All	
Rhonda Ridenhower	TestAmerica St. Louis/Laboratory PM	314-787-8227		All	
Kevin Harmon	Validata Chemical Services, Inc. (Validata)/Data Validator (3rd Party)	770-232-0130		All	
TBD[2]	Gilbane/Field Crew	Various		All	
TBD[2]	Gilbane/Field Crew	Various		All	
TBD[2]	Gilbane/Field Crew	Various		All	
TBD[2]	Gilbane/Field Crew	Various		All	

Note:
[1]To be determined. The indicated team member has yet to be selected. These fields will be completed before submission of the Final SAP.
[2] Field crew members will be selected at task startup. Persons identified by the PQCM will read the SAP and sign this worksheet as required. Their identities and the number of required personnel have not been determined at the time of publication.

SAP Worksheet #5 – Project Organizational Chart



SAP Worksheet #6 – Communication Pathways

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure
Approvals	Navy QAO Navy RPM RASO	Joseph Arlauskas Leo Larson Dave Weyant	joseph.arlauskas@navy.mil llarson@scst.com david.weyant@navy.mil	Gilbane PM to request approval of SAP from QAO and approval of Remedial Action Work Plan (RAWP) from Navy RPM via email, with radiological review and concurrence of both plans to be obtained from RASO. Draft WP/Appendices to be submitted as hard copy to regulatory agencies for comments via email in 30 days. Gilbane PM to respond to regulatory comments via email within 2 weeks and revise as necessary to obtain concurrence on WP/Appendices. PM to acquire approval to initiate field work from Navy RPM and QAO after appropriate agency concurrence has been obtained.
Project management	Gilbane PM	John Baur	jbaur@gilbane.com	If changes are necessary, the PM communicates the changes via phone and/or email to the project staff and is authorized to stop work, if necessary. PM to provide Navy RPM and ROICC with all project-required notifications within 24 hours.
SAP review	Gilbane Program Chemist Gilbane QCPM	Kristen Carlyon Peyton Laura Tryboski	kcarlyon@gilbaneco.com ltryboski@gilbaneco.com	The SAP is written by the Program Chemist and reviewed by the QCPM prior to submittal to the Navy QAO for review.

SAP Worksheet #6 – Communication Pathways (Continued)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure
SAP procedure revision during field activities	Gilbane Project Chemist	Kristen Carlyon Peyton	kcarlyon@gilbaneco.com	The Project Chemist (or designee) will prepare a Field Change Request (FCR) for any minor changes in sampling procedures that occur due to conditions in the field.
SAP amendments	Gilbane Project Chemist	Kristen Carlyon Peyton	kcarlyon@gilbaneco.com	Significant changes to the SAP, such as the addition of sampling methods or analyses, will require that the Project Chemist prepare an addendum, which will be reviewed and approved by the Navy QAO prior to initiating the affected field activities. Any SAP addendum also will be submitted to the regulatory agencies for review. Regulatory agencies will be notified via email within 1 week of all significant changes to the SAP that do not require approval.
Notification of non-usable analytical data	Gilbane Project Chemist	Kristen Carlyon Peyton	kcarlyon@gilbaneco.com	If significant problems are identified by the laboratory or the project team that impact the usability of the data (i.e., the data is rejected or the DQOs are not met), the Project Chemist will notify the PM; Navy RPM and Navy QAO will be notified within 24 hours or the next business day.

SAP Worksheet #6 – Communication Pathways (Continued)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure
Coordination of laboratory supplies for field sampling activities	Gilbane Project Chemist	Kristen Carlyon Peyton	kcarlyon@gilbaneco.com	The Project Chemist will contact the subcontract laboratory to provide necessary sample containers and appropriate shipping materials (such as coolers and bubble wrap) to be delivered to the site prior to commencement of field sampling activities and throughout the course of the project.
Reporting laboratory data quality issues or analytical corrective actions	TestAmerica St. Louis/ Laboratory PM	Rhonda Ridenhower	rhonda.ridenhower@testamericainc.com	Data quality issues will be reported to the Project Chemist within 24 hours. Any corrective actions will be documented and verified by the Project Chemist, who will notify the PQCM, Site RSO (if applicable) and the PM in writing. The PM will notify the BRAC RPM and RASO (if applicable).
Stop work issues	All Gilbane and Navy Staff	Various	Various	The initiator of a stop work order verbally notifies Navy ROICC and Gilbane PM immediately. For stop work initiated by the Navy, the Contracting Officer must be verbally notified within 24 hours.
Field corrective actions	Gilbane PQCM	Teresa Ruha	truha@gilbaneco.com	Field corrective actions will be documented in writing by the PQCM, who will notify the Site RSO (if applicable) and PM in writing. The PM will notify the BRAC RPM and RASO (if applicable). Regulatory agencies will be notified via email within one week of all substantive field corrective actions.

SAP Worksheet #7 – Personnel Responsibilities and Qualifications Table

(UFP-QAPP Manual Section 2.4.3)

Name	Title/Role	Organizational Affiliation	Responsibilities
Leo Larson	Navy Project Manager	BRAC PMO	Oversees project execution and coordination with site representatives, regulatory agencies, and Navy management. Actively participates in the DQO process, and provides management and technical oversight during data collection. Is notified of delays in or changes to field work and has authority to stop work and initiate corrective action at any time.
Joseph Arlauskas	Navy QAO	NAVFAC SW	Responsible for QA issues for all Navy work; provides government oversight of the QA program for contractors. Reviews and approves the SAP and any significant SAP modifications or amendments; has the authority to suspend project activities if Navy quality requirements are not met.
Dave Weyant	Project Manager	RASO	Reviews radiological laboratory on a routine basis. Performs on-site reviews of all radiological site operations. Reviews and approves final reports. Performs quality reviews on chains of custody (COCs) to ensure samples are handled in accordance with the Work Plan (WP) and SAP. Provides review and concurrence on data for proposed radiological actions. Ensures that all necessary sample results are provided and are consistent with proposed radiological actions.
Laura Tryboski	QC Program Manager (QCPM)	Gilbane	Reviews QC processes, issues corrective action orders; assures adherence to requirements of the QC program, including the QA/QC Plan, and SAP, as appropriate. Can receive communication from the PM, Program Chemist, PQCM, and field staff. Has the authority to stop work and initiate corrective action.
Teresa Ruha	PQCM	Gilbane	Implements field-related quality control activities, issues nonconformance reports (NCRs), initiates necessary rework and/or corrective actions, and communicates with the PM, QCPM, Superintendent, and Project Chemist.

SAP Worksheet #7 – Personnel Responsibilities and Qualifications Table

Name	Title/Role	Organizational Affiliation	Responsibilities
John Baur	Project Manager	Gilbane	Develops and implements all Task Order documents and activities. Assures overall project quality, implementation of three-phase quality control activities, and compliance with project schedule; and performs contract management, technical oversight, and report generation. Responsible for notifying the RPM of significant project information, including (but not limited to) project progress, schedule compliance, modifications to work, delays, analytical data quality issues, and safety-related issues.
Kristen Carlyon Peyton	Program/Project Chemist	Gilbane	Assists the QC Program Manager and assesses the propriety of the proposed analytical methodology; assists in the preparation of the SAP and with management of project tasks associated with sampling; reviews preservation requirements; coordinates SAP review/approval and other QA issues with the Navy QAO; conducts general oversight of and communication with the field personnel in relation to sampling activities; coordinates sample collection and analysis with the analytical laboratory; implements appropriate quality control activities and corrective actions; coordinates data validation activities and the uploading of data to appropriate databases. Coordinates third-party data validation of all definitive laboratory data. Reviews data validation reports.
Jerry Cooper	Corporate RSO/Certified Health Physicist	Gilbane	Oversees overall radiological operations. Insures that Site RSO and filed sampling personnel have adequate training in radiological sample collection. Oversees the preparation of remediation plans and the performance of remediation activities when sampling activities indicate the presence of radioactive materials at levels above the release criteria. Acts as a technical resource for radiological data collection for analysis, and technical discussions with stakeholders. Reviews radiological data to ensure the DQOs have been met. Provides critical analysis and interpretation of radiological data.

SAP Worksheet #7 – Personnel Responsibilities and Qualifications Table

Name	Title/Role	Organizational Affiliation	Responsibilities
Chris Bryson	Site RSO	Envirachem	Supervises day-to-day radiological operations. Oversees performance of radiological static surveys. Collects and maintains records of instrument calibration and maintenance. Collects and maintains completed survey forms, chain of custody records, field log sheets, and other field data. Integrates field, graphical information system (GIS), and global positioning system (GPS) data and plot data on maps.
Tony Olmstead	Superintendent	Gilbane	Conducts oversight of all field activities; ensures implementation of individual elements of site or task-specific work plans; oversees the work of subcontractors performing field-related tasks; and oversees the collection of samples and coordinates shipments with laboratories. Ensures that the sampling protocol is followed in accordance with the SAP.
Rhonda Ridenhower	Laboratory PM	TestAmerica St. Louis	Performs chemical analyses; assures compliance with project requirements regarding performance of analytical procedures; supplies sample containers; handles and preserve samples in accordance with project-specified protocols.
Kevin Harmon	Data Validator	Validata	Performs data validation on analytical data used for project decisions.

SAP Worksheet #8 – Special Personnel Training Requirements Table
(UFP-QAPP Manual Section 2.4.4)

Project Function	Specialized Training By Title or Description of Course	Training Provider	Training Date	Personnel / Groups Receiving Training	Personnel Titles / Organizational Affiliation	Location of Training Records / Certificates
Radiation-impacted area sampling	Radiation Safety Awareness Training	Gilbane	Prior to field work	All project field personnel	Gilbane / Excavation or Demolition Subcontractors	Gilbane, Concord, CA

Training Requirements

Project personnel are required to meet the U.S. Occupational Safety and Health Organization (OSHA) training requirements defined in Title 29 Code of Federal Regulations (Title 29 CFR) Part 1910.120(e). These requirements are: (1) 40 hours of formal off-site instruction; (2) a minimum of 3 days of actual on-site field experience under the supervision of a trained and experienced field supervisor; and (3) 8 hours of annual refresher training. In addition, training will be provided to all field team members working in radiation-impacted areas according to the requirements of 10 Code of Federal Regulations (CFR) 19.12, Instructions to Workers.

SAP Worksheet #9 – Project Scoping Session Participants Sheet
(UFP-QAPP Manual Section 2.5.1)

Project Name: Former Naval Station Treasure Island

Site Name: Installation Restoration Site 12

Site Location: San Francisco, California

Projected Date(s) of Sampling: March 2018 through June 2018

Project Manager: John Baur

Date of Scoping Session: August 15, 2017

Scoping Session Purpose: Describe scope of work

Scoping Session Participants:

Name	Title	Affiliation	Phone	E-mail Address	Project Role
Dave Clark	Lead RPM	Navy BRAC	619-524-6870	David.j.clark@navy.mil	Lead RPM
Chris Yantos	RPM	Navy BRAC	619-524-6023	Christopher.yantos@navy.mil	RPM
John Baur	Project Manager	Gilbane	925-946-3212	jbaur@gilbaneco.com	PM

Comments/Decisions:

No decisions were made at the scoping meeting. The following issues were discussed:

- Community relations logistics will need to be worked out and closely coordinated by Gilbane and Navy.
- Project Schedule and sequencing of field work.
- Submittal of Project Plans.
- Changes in Navy organization for the project. New RPM will be starting and will take over as RPM for this project. Will work very closely with Chris and Dave.

Action Items:

(1) Gilbane to revisit project schedule regarding duration of field work for continuing excavation of the previously started NTCRA.

(2) Navy will provide schedule for tenants moving out of buildings scheduled to be demolished so Gilbane can schedule boarding and fencing the buildings.

(3) Navy will look into availability of B570 for office use during RA.

Consensus Decisions:

No consensus decisions were reached at the meeting.

SAP Worksheet #10 – Problem Definition
(UFP-QAPP Manual Section 2.5.2)

As the lead federal agency, the Navy, including RASO, is working with DTSC and the Water Board to develop and implement the remedial action/NTCRA. These entities make up the planning group. The Navy coordinates activities at NSTI with the regulatory agencies under the terms of the 1992 Federal Facility Site Remediation Agreement. Navy, DTSC, and Water Board representatives are collectively referred to as the BRAC Cleanup Team (BCT) for NSTI. In addition, the CDPH works with DTSC to provide technical support on the radiological program. Other agencies and organizations also provide support to the BCT and the environmental program, including TIDA, the Treasure Island Community Development (also known as TICD), the Restoration Advisory Board (also known as RAB), the EPA, and other public groups.

The intent of this remedial action/NTCRA is to complete the work to support no further action for COCs in the IR Site 12 non-SWDAs and the North Point SWDA. The RAOs are to reduce risk to current and future residents by minimizing the dermal contact, incidental ingestion, and inhalation with soil containing known COC concentrations by excavating discrete locations with COCs above their RGs and disposing of the soil off-site. This includes confirming that Ra-226 soil concentrations are below release criteria. Groundwater monitoring is associated with this project, but achieving the RAOs for groundwater is not a performance objective. A secondary objective of this project is to collect radiological data representative of post-remedial action or “as-left” conditions of each excavation to refine the Site 12 CSM for areas outside of the SWDAs; specifically to address the presence and extent of radioactive contamination due to housing construction grading.

10.1 Site Description and History

NSTI is located in the City and County of San Francisco (CCSF), California, between San Francisco and Oakland in the San Francisco Bay (Figure 1). NSTI consists of two contiguous islands connected by a causeway. Treasure Island encompasses approximately 403 acres, and the southern island, Yerba Buena Island, encompasses approximately 147 acres. Treasure Island was constructed of materials dredged from the San Francisco Bay from 1936 to 1937 for the Golden Gate International Exposition of 1939 and 1940. Yerba Buena Island is a natural rock island (Navy, 2017).

In 1940, the U.S. Department of the Navy (Navy) began leasing TI from the CCSF and later, during World War II, gained full ownership of Treasure Island. The island became a major Navy base and was used primarily for training, administration, housing, and other support services to the U.S. Pacific Fleet. In 1993, the Base Realignment and Closure (BRAC) Commission, pursuant to the Defense BRAC Act of 1990, recommended closure of NSTI. The base was closed on September 30, 1997 (Navy, 2017).

Site 12 is located on the northeastern part of the island (Figure 1). During the Golden Gate International Exposition in 1939 and 1940, the majority of the area that now encompasses IR Site12 was used for vehicle parking. After the Navy took over the lease of NSTI and throughout the 1940s, 1950s, and 1960s, ammunition bunkers were located in the northern half of IR Site 12.

SAP Worksheet #10 – Problem Definition (Continued)

From the early 1940s until about 1968, 21 ammunition bunkers were located in the IR Site 12 area. Disposal units and general solid waste disposal areas (SWDAs) were in the vicinity of some bunkers. The southern part of IR Site 12 also included part of a former runway, general storage, fueling station, and miscellaneous buildings. From approximately 1966 to 1988, four military housing series (1100, 1200, 1300, and 1400 series) were constructed at IR Site 12. The 1100, 1200, 1300 and 1400 series buildings were completed in 1966, 1969, 1974 and 1988, respectively (Navy, 2017).

Site 12 was entered in the CERCLA process in 1988 because of findings in the Final Preliminary Assessment/Site Inspection report (Dames and Moore, 1988). These findings documented the potential for soil and groundwater contamination from debris that may not have been entirely removed during housing construction. The concentrations and distribution of COCs and solid waste within the residential housing areas are uncertain because the distribution of solid waste and COCs resulting from grading operations is variable. In 2002, the Site 12 boundary was expanded to include all existing residential areas (Navy, 2017).

10.2 Site Characteristics

The prevailing wind direction for the Bay area is from the northwest. Wind speed is less than 6 miles per hour more than 50 percent of the time and exceeds 12 miles per hour approximately 10 percent of the time. The strongest winds are associated with winter storms. In the winter, winds from the north and east sometimes bring low temperatures to the Bay area. Westerly winds predominate during the summer when cool marine air flows east toward the warm Central Valley region of California. These winds are strongest in the late afternoon and early evening (TriEco-Tt, 2012).

Temperature at Treasure Island is influenced by the Pacific Ocean and the resulting maritime climate. Temperature data have been collected at the Oakland Museum (the nearest weather station) for a 30-year period of record. The average annual temperature is 59.5 degrees Fahrenheit (°F), the average summer temperature is 64.8 °F, and the average winter temperature is 52.2 °F. The warmest month of the year is usually September (average temperature 74.6 °F). Daily extremes for the period of record are 107 °F (recorded on June 8, 1973) and 26 °F (recorded on December 9, 1972) (Navy, 1987). Mean annual evaporation is 48 inches; the greatest evaporation occurs during July (Navy, 1987).

Precipitation data have been collected at the Oakland Museum for a 30-year period of record. The average annual precipitation is 21.3 inches. The average precipitation by season is the spring is 4.8 inches in spring, 0.3 inches in summer, 4.3 inches in fall, and 11.9 inches in winter. Approximately 90 percent of the annual precipitation occurs from November to April with 19.2 inches of rain. Localized showers are infrequent and storms are generally moderate in duration and intensity. The maximum rainfall recorded in a 24-hour period was 4.74 inches on January 4, 1982. Mean annual evaporation is 48 inches; the greatest evaporation occurs during July (Navy, 1987).

SAP Worksheet #10 – Problem Definition (Continued)

Relative humidity during the winter is approximately 50 to 60 percent during the day, increasing to approximately 80 to 90 percent at night. Humidity decreases in the spring; however, by summer, it increases when frequent fogs occur, particularly at night or in the morning. Humidity is lowest in the fall, ranging from approximately 50 percent during the day to 70 percent at night (Navy, 1987).

Treasure Island is a relatively flat manmade island, consisting primarily of sediment dredged from the Bay and retained by a perimeter of rock and sand dikes. In general, the soil found is poorly graded, fine-grained sand with occasional discontinuous lenses of silt and clay. The groundwater table is encountered at an average depth of approximately 5 feet below ground surface (bgs) but may be shallower in the removal action areas. Generally, groundwater flow is radial from the center of the island toward the shoreline.

IR Site 12 is flat, consisting of open grassy areas between buildings, paved roads, and parking areas.

Site 12 was leased to TIDA, and TIDA subsequently subleased select housing units. Currently, Site 12 contains residential buildings (about 900 housing units) that are two-story structures constructed with slab-on-grade foundations with four to eight residential units per building.

Following environmental restoration of the site, the entirety of IR Site 12 will be transferred to the CCSF. Redevelopment plans by the CCSF are described in the Naval Station Treasure Island Reuse Plan-Public Review Draft (CCSF, 1996) and the Treasure Island/Yerba Buena Island Final Environmental Impact Report (CCSF, 2011). Redevelopment plans include designated areas for Residential/Open Space/Publicly Oriented Uses/Shoreline Open Space.

10.3 Previous Investigations and Removal Actions

Table 10-1, adapted from Table 1 of the Final Record of Decision/Final Remedial Action Plan for Installation Restoration Site 12(Non-Solid Waste Disposal Areas and Non-Radiological) Former Naval Station Treasure Island, San Francisco, California (ROD/Final RAP; Navy, 2017) summarizes the previous investigations completed for Site 12 in the first section, followed by the previous and ongoing removal actions in the second section.

Table 10-1: Previous Investigations and Previous and Ongoing Removal Actions

Investigation[1]	Date	Investigation Summary
Previous Investigations		
PA/SI	1988	A PA/SI (preliminary assessment/site inspection) was completed for NSTI to identify and assess sites where contamination from past hazardous materials operations posed a potential threat to human health or the environment. The PA/SI identified 26 sites at NSTI including Site 12. Site 12 was identified based on the ammunition bunkers, cell-type disposal units, and general debris disposal areas.

SAP Worksheet #10 – Problem Definition (Continued)

Table 10-1: Previous Investigations and Previous and Ongoing Removal Actions

Investigation[1]	Date	Investigation Summary
Previous Investigations		
Preliminary Risk Assessment	1992	A preliminary risk assessment was completed to assess potential health risks from exposure to contamination at Site 12. The Navy performed a geophysical survey using ground-penetrating radar. Soil samples were collected from areas with ground-penetrating disturbances and debris areas. Soil samples were analyzed for metals, pesticides, polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs). Based on the results, additional soil samples were collected. The results of the soil sampling were included in the remedial investigation (RI) data set.
Groundwater Monitoring	1992-present	The Navy has conducted groundwater monitoring at Site 12 since 1992. The groundwater monitoring identified elevated concentrations of arsenic in groundwater in the vicinity of Buildings 1311 and 1313 (now known as the Gateview Arsenic/TPH Area). Elevated petroleum concentrations in soil and groundwater were also reported in that area. The elevated concentrations were most likely the result of releases from a suspected former waste oil tank in the area. In 2005, an investigation into the elevated concentrations of arsenic concluded that the petroleum conditions caused naturally occurring arsenic in soil to be mobilized into the groundwater.
Tidal Mixing Studies	1995-2002	In 1995, an initial study assessed the inland extent of tidal influence on near-shore groundwater levels at former NSTI. During the first study, fluctuations in the groundwater table between high and low tides ranged from 1.81 feet at a distance of 30 feet from San Francisco Bay to 0.12 foot at a distance of 250 feet from San Francisco Bay. The tidal fluctuation in San Francisco Bay was measured at 5.37 feet during the corresponding period. A follow-up study was performed between December 2001 and March 2002 to assess the degree of subsurface mixing of groundwater and surface water immediately inland of the shore at Treasure Island. The findings from these studies estimated that physical mixing of surface water and groundwater takes place over distances ranging from 60 to 150 feet inland of the Treasure Island mean lowest low water shoreline.
Ambient Metals Studies	1996-2001	Ambient concentrations were established for metals in soil and groundwater to assess whether the presence of any metal was the result of a site-specific release or if it was from naturally occurring or regional anthropogenic sources. A study of the ambient concentrations of metals in soil was conducted in 1996; the ambient groundwater metals concentrations study was completed in 2001. These studies are included as Appendices D and E of the final Site 12 RI report.

SAP Worksheet #10 – Problem Definition (Continued)

Table 10-1: Previous Investigations and Previous and Ongoing Removal Actions

Investigation[1]	Date	Investigation Summary
Previous Investigations		
Draft Final Onshore RI	1997	An RI was completed for all sites identified in the PA/SI, including Site 12, to assess the nature and extent of potential petroleum and metals contamination and to evaluate whether the debris disposal areas, former ammunition bunker areas, and the former buried oil tank (in the Gateview Arsenic/TPH Area were continuing sources of contamination. The RI was completed in three phases (I, IIA, and IIB). Phase I consisted of installing and monitoring four groundwater monitoring wells. Phase IIA, consisted of completing groundwater hydraulic parameter tests, a tidal influence study, and groundwater sampling. Phase IIB consisted of collecting two to three soil samples and one groundwater sample from each of the 108 direct-push borings. The samples were analyzed for VOC, SVOCs, TPH, explosives, metals, and dioxins at selected locations. Results of the RI indicated that metals, PAHs, and TPH concentrations were detected throughout the site, and dioxins were detected in localized areas. PAHs, VOCs, pesticides, PCBs, explosives, metals, and TPH were detected in groundwater, with VOCs and TPH being detected most frequently in the southwestern corner of the site. After this RI, the Site 12 boundary was expanded to include a rubbish disposal area (SWDA A & B, now referred to as SWDA Westside).
EBS	1997-1998	The Navy completed an environmental baseline survey (EBS) in 1997 and a revision to the EBS in 1998. Reuse Zone 4 encompasses most of Site 12 and included EBS parcels T96, T97, T100, T101, and T103. The EBS provided recommendations for areas suitable for lease, and areas where restrictions should be applied until further investigation was completed.
Draft Site 12 Operable Unit RI	1999	In early 1998, Site 12 was separated from the other onshore sites based on the additional data collected at Site 12 and unexpected delays in completing the onshore RI report. In addition, the City of San Francisco had announced its plans to lease the former housing areas within the site as public rental units. The RI concluded that risks associated with SWDA Westside and the remainder of the site were within the risk management range of 10^{-4} to 10^{-6} for residential users, recreational users, commercial/industrial users, and construction workers. The noncancer hazard risk for all users was less than 1, except for residential exposure to surface soil in SWDA Westside, which was equal to 1. Lead in soil at both the SWDA Westside and the remainder of the site was found at concentrations well below the screening concentrations for the residential user based on the DTSC blood lead model and modified DTSC model.

SAP Worksheet #10 – Problem Definition (Continued)

Table 10-1: Previous Investigations and Previous and Ongoing Removal Actions

Investigation[1]	Date	Investigation Summary
Previous Investigations		
Exploratory Trenching and Sampling	2000-2003	The Navy pothole sampled back yards in Buildings 1205 and 1211 in August 2000. There were no significant detections in the backyards of Building 1205. There were varied detections of lead, PCBs, and PAHs above screening criteria in the four Building 1211 backyards. The Navy conducted additional trenching and sampling at 15 buildings scheduled for leasing. Sampling results identified three hotspots. Two hotspots were outside previously known areas of contamination and the third was behind Building 1413. Interim measures such as fencing off areas of known debris contamination and installation of cover in several backyards of occupied residents were also undertaken. Fencing was installed around SWDA Westside, SWDA Bayside, and SWDA North Point. Warning signs were posted around the perimeter of the fenced area. Back yards where samples exceeded criteria were covered with either sod or concrete pavers. In September and October 2003, the Navy conducted additional trenching, excavating 581 exploration trenches, seven step-out trenches, and seven step-out hand auger locations and collected samples. The investigation was limited to common areas outside of the SWDAs, specifically excluding areas previous remediated, areas scheduled for future remediation, and hardscape areas. The results of this investigation helped further refine the SWDA boundaries.
Initial Soil Gas Investigation with SWDA A & B (now known as SWDA Westside)	2000	The Navy completed a shallow soil gas survey to investigate potential VOCs and methane generation and migration within the SWDA A & B and to evaluate the nature and extent of VOC and methane suspected during previous investigations at Site 12. Soil gas samples were collected from 70 locations within Site 12. VOCs were present at concentrations exceeding screening criteria in only one location, near Building 1323. Methane was detected at numerous locations in SWDA Westside, Northpoint Drive, and Gateview Avenue areas. Additional soil gas samples were collected to delineate these VOC and methane detections. The results of the step-out sampling delineated the extent of VOC contamination to a small area between Building 1323 and a riprap area. The methane detections in the SWDA Westside, Northpoint Drive, and Gateview Avenue areas correlated with natural gas pipelines. In January 2002, the Navy capped the natural gas pipeline in the SWDA, allowed remaining gas to dissipate, and then resampled locations along the line. Results showed methane was no longer present at concentrations exceeding screening criteria. Methane in soil gas at concentrations above screening criteria continued to be detected near Buildings 1319 and 1321. Chloromethane was detected in soil gas samples collected from the vicinity of Building 1323 within SWDA Westside and in indoor air at Building 1323. However, chloromethane from soil gas was determined not to be the source of the chloromethane in indoor air because concentrations in soil gas were low.

SAP Worksheet #10 – Problem Definition (Continued)

Table 10-1: Previous Investigations and Previous and Ongoing Removal Actions

Investigation[1]	Date	Investigation Summary
Previous Investigations		
Offshore Sediment RI	2001	In 1996, the Navy designated the offshore area at NSTI as its own OU. The offshore area of Site 12 was designated as Area G. Sampling included chemical analysis of sediment, stormwater, and sediment pore water. One of the primary focuses of the sampling was to evaluate potential contamination to offshore sediment from stormwater outfalls. The RI found that chemical concentrations in the sediment were low and no debris was present in the sediment. As a result, the RI concluded that no further action was necessary for Area G of the offshore sediment. The Navy and the state signed a No Action ROD for the offshore sediment in 2005.
HRA	2006	An Historical Radiological Assessment (HRA) was completed in 2006 to designate sites on former NSTI as either impacted by radionuclides, meaning the site has, or at one time had, the potential for residual radioactive contamination; or non-impacted, meaning there is no reasonable possibility for residual radioactive contamination. The HRA found the four SWDAs (SWDA Westside, SWDA Bayside, SWDA North Point, and SWDA Bigelow Court) could contain radioluminescent devices. Therefore, radiological surveys were recommended for the SWDAs. The HRA also identified the USS Pandemonium, a full-scale mockup of a patrol craft training ship used for radiological decontamination training. It was located on the northwest part of Treasure Island, at what is currently part of Site 12, until 1969. The HRA concluded that the former location of the USS Pandemonium was not impacted.
SLERA	2007	An ecological survey of Site 12 was conducted in March 2006 as part of a screening-level ecological risk assessment (SLERA) for former NSTI. The survey concluded that Site 12 consisted of residential areas with landscaped vegetation and that former NSTI was not a natural ecosystem. The SLERA concluded that no further evaluation of ecological risk was necessary for Site 12 because of the overall poor quality of habitat on former NSTI and because future exposure would be limited to species adapted to urban, landscaped habitats similar to what was currently present.

SAP Worksheet #10 – Problem Definition (Continued)

Table 10-1: Previous Investigations and Previous and Ongoing Removal Actions

Investigation[1]	Date	Investigation Summary
Previous Investigations		
Technical Memorandum for PCBs in Indoor Air at Halyburton Court, IR Site 12	2007	In October 2000, indoor air sampling was conducted at Halyburton Court, focusing on Building 1100. Results indicated the presence of low-molecular-weight PCBs that are potentially volatile and could partition in the vapor phase. Additional samples were collected, and the Navy completed an evaluation of the vapor intrusion pathway. Buildings 1100, 1102, 1104, and 1106 in Halyburton Court have remained unoccupied as a result of the analysis.
Targeted Investigation of Volatile Organic Compounds in Soil Gas	2009	The Navy investigated VOCs in soil gas to characterize the vapor intrusion pathway and identify any existing soil gas plumes. Soil vapor from 95 distinct locations within four areas (Exposure Units [EUs] 8, 15, and 17 and Area of Interest [AOI] Mariner Drive) was sampled an analyzed in a mobile laboratory. The Navy collected an additional 40 samples in other EUs to augment the risk assessment dataset where samples for VOCs had not been previously collected for soil gas or groundwater. Benzene was the only compound that exceeded its individual California Human Health Screening Level (CHHSL) at three locations (two in EU 16 and one in EU 10). Benzene was the largest contributor to the risk at the location where the cumulative CHHSL was exceeded. No soil gas plumes were identified. Methane detections were attributed to subsurface natural gas pipelines, and on further investigation by the San Francisco Public Utilities Commission were found not to be a hazard with no major pipeline leakage.
RI	2012	The Navy completed an RI for Site 12 to: (1) characterize site conditions; (2) evaluate the nature and extent of contamination in soil, groundwater, and soil gas; and (3) assess the risk to human health and the environment. Site 12 was divided into two regional areas: Site 12 north and Site 12 south. Site 12 north and south were further subdivided into 19 EUs, six AOIs, seven groundwater exposure areas, and the four SWDAs. Three petroleum areas were identified: (1) the Building 1311/1313 area (now known as the Gateview Arsenic/TPH petroleum area); (2) the Mariner Drive petroleum area, located 600 feet inland from the northern shore of the island; (3) suspected UST 267, located near the northeastern corner of Site 20 within Site 12. The Navy was unable to locate the underground storage tank (UST), and it was concluded that the UST did not exist. In 2003, the Water Board concurred with the Navy's request for no further action for UST 267. A total of 4,039 samples were collected from Site 12 (3,607 soil samples, 322 water samples, and 110 soil gas samples). The samples were analyzed for TPH, VOCs, SVOCs, pesticides, PCBs, metal, explosives, and dioxins and furans. Sampling results were compared with screening criteria to identify chemicals that exceeded the screening criteria. Chemicals in soil exceeding the screening criteria include petroleum, PAHs,

Table 10-1: Previous Investigations and Previous and Ongoing Removal Actions

Investigation[1]	Date	Investigation Summary
Previous Investigations		
		PCBs, pesticides, metals, and dioxins. Chemicals in groundwater exceeding the screening criteria include petroleum and metals. Chemicals in soil gas exceeding the screening criteria include benzene and chloroform. A baseline human health risk assessment (HHRA) was also completed in the RI.
FS	2014	The Navy completed a feasibility study (FS) to: (1) supplement the site characterization information from the 2012 RI with a data gaps investigation; (2) identify applicable or relevant and appropriate requirements (ARARs); (3) identify RAO and remediation goals; and (4) evaluate remedial alternatives. The Navy completed a data gaps investigation and documented the results in the FS. The objective of the data gap investigation was to define the lateral and vertical extent of the COCs identified in the RI. The data gaps investigation included collection of samples to define the lateral and vertical extent of contamination for: • Lead at EU 6, EU 7, EU 14, and AOI Mariner Drive • Hexavalent chromium at EU 4, EU 5, and AOI Mariner Drive • Dioxins and furans at EU 16, EU 17, AOI 1201/1203/1220, and AOI Mariner Drive • PCBs at EU 9, AOI 1254, AOI Halyburton/Bigelow Court • PAHs at EU 5 and EU 6 • Pesticides at AOI 1254 • TPH Data indicated that the lateral and vertical extent of lead were defined, and lead was retained as a COC for EU 6, EU 7, EU 14, and AOI Mariner Drive. Data indicated that hexavalent chromium was present at EU 4, EU 5, and AOI Mariner Drive, so chromium was retained as a COC for these locations. Data indicated the lateral and vertical extent of PCBs were defined at EU 9 and AOI Halyburton/Bigelow Court, and PCBs were retained as a COC at these locations. Data also confirmed the removal of PCB contamination at AOI 1254 from a previous removal action, so PCBs were not retained as a COC for AOI 1254. Data indicated the lateral and vertical extent of PAHs at EU 5 and EU 6 were defined, so BaP EQ was retained as a COC for these locations. Data confirmed the removal of pesticide contamination at AOI 1254 when the previous PCB removal action was completed. Data indicated that the lateral and vertical extent of the TPH in the Gateview Arsenic/TPH Area were defined. The alternatives developed and evaluated in the FS were superseded by the alternatives developed and evaluated in the FS addendum.
HRASTM	2014	In 2014, the Navy completed additional research to better understand the radiological materials that were found on Treasure Island and the historical disposal processes for the low-level radioactive waste. As a result of the research, new areas at former NSTI were designated as potentially radiologically impacted. This area included all of Site 12, because it was a

Table 10-1: Previous Investigations and Previous and Ongoing Removal Actions

Investigation[1]	Date	Investigation Summary
Previous Investigations		
		former site of the USS Pandemonium and a gyro compass repair shop, and the presence of the SWDAs (which was identified in the HRA) with the potential for low-level radiological objects or contamination to have been spread outside of the SWDAs during development of the housing areas. The Historical Radiological Assessment Supplemental Technical Memorandum (HRASTM) recommended a characterization survey, remediation of radiologically impacted areas, and a gamma walkover survey for areas outside the radiologically impacted SWDA boundaries. The ROD/Final RAP does not address potential radiological contamination at Site 12. Radiological contamination is being addressed by separate CERCLA documents.
FS Addendum	2015	The Navy completed an FS addendum to: (1) update site characterization information from the 2012 RI and 2014 FS with another data gaps investigation; (2) investigate potential contamination from a rubbish area identified on historical figures; (3) reassess the 2007 SLERA; (4) present basis for no further action determination at groundwater exposure area GW-S5 based on monitoring results; and (5) develop and evaluate remedial alternatives. Eight trench locations were excavated to assess the presence and extent of contamination in the rubbish area. The trenches were dug approximately 4 feet wide by 6 feet long and up to 8 feet bgs. Data indicate that there is no chemical contamination above remediation goals in the eight trenches and household debris was discovered only in trenches 6 and 7, and was minimal and localized. Soil sampling was performed in EU 3, EU 4, and EU 19 to assess a discrepancy in data for PAHs and in EU 17 to address a discrepancy in data for dioxins. Data from the data gaps sampling indicated that PAHs are not present at concentrations above the remediation goal in the discrepancy locations in EU 3, EU 4. As a result PAHs were not retained as a COC for EU 3 and EU 4. Data also indicated that PAHs were not present above the remediation goal in locations identified as having a discrepancy in data at EU 19; however, concentrations of PAHs above the remediation goal remain at other locations. As a result, BaP EQ was retained as a COC for EU 19. Data confirmed the dioxin contamination at EU 17, so 2,3,7,8-TCDD TEQ was retained as a COC for EU 17. Soil samples were collected in eight EUs and three AOIs to assess whether contamination extended underneath buildings. Results of the data gaps sampling indicated that lead, dioxins, and PCBs did not extend underneath buildings; however, PAHs at concentrations above the remediation goal extended underneath Building 1217. Samples were also collected in the Gateview Arsenic/TPH area to further define the lateral and vertical extent of petroleum contamination. Results from the data gaps sampling indicated that petroleum contamination did not extend

Table 10-1: Previous Investigations and Previous and Ongoing Removal Actions

Investigation[1]	Date	Investigation Summary
Previous Investigations		
		outside of the previously defined source area. Soil gas samples were collected to further define the lateral and vertical extent of soil gas COCs in EU 16. Results from data gaps sampling indicate that concentrations of benzene in soil gas are no longer detectable and do not require further investigation or remediation. Groundwater monitoring conducted from 2007 to 2009 indicated concentrations of arsenic in groundwater have been below the screening criteria (36 µg/L) since 2008. Based on the results, no further action is necessary for groundwater area GW-S5.
Previous and Ongoing Removal Actions		
Removal Action of Lead-Contaminated Soil, SWDA Bayside and North Point	1999-2000	A soil removal action for lead was conducted in 1999 in the vicinity of Buildings 1207 and 1209 in the northern portion of IR Site 12 in which approximately 2,200 cubic yards of soil were excavated and replaced with clean fill. As a result of the findings, the additional investigations in August 2000 in the vicinity of Buildings 1235, 1205, and 1211 lead to the expansion of SWDA North Point to include Building 1235 and the back yard of Building 1237 Unit A, and SWDA Bayside to include Building 1211.
Removal Action of PCB-Contaminated Soil, Halyburton Court Area	2000	Soil investigations in late 1999 revealed soil concentrations of PCBs that exceeded the cleanup goal of 1 mg/kg in the Halyburton Court area. The Navy undertook a removal action to excavate and dispose of PCB-contaminated soil off-site. The excavation also removed collocated concentrations of PAHs. Soil was excavated to a maximum depth of 4 feet bgs in an approximately 2-acre area. Confirmation samples collected from the floor of the excavation at depths below 4 feet bgs and in some sidewalls beneath structures indicated PCBs exceeding 1 mg/kg were left in place. Approximately 11,300 cubic yards of soil was removed. Excavated soil was transported off site for disposal. The removal action was completed in August 2000.
Time-Critical Removal Action for PCB- and PAH-Contaminated Soil	2002	In October 2001, the Navy undertook a time-critical removal action in the area behind Building 1413 in Flounder Court, Building 1252 Exposition Drive, Building 1254 13th Street, and Buildings 1246 and 1248 Gateview Court. The objective of the removal action was to remove soil contaminated with lead, PCBs, and PAHs. The maximum depth of the excavations was 4 feet bgs. Approximately 800 cubic yards of soil was removed. Excavated soil was transported off site for disposal. The removal action was completed in January 2002.

Table 10-1: Previous Investigations and Previous and Ongoing Removal Actions

Investigation[1]	Date	Investigation Summary
Previous Investigations		
Phase I Non-Time-Critical Removal Action for PCBs, PAHs, Dioxin/Furans, Lead, and Ra-226 at SWDA Northpoint	2007	In 2007, the Navy undertook a non-time-critical removal action at at SWDA North Point. The objective of the project was to remove soil contaminated with lead, PCBs, PAHs, and dioxin/furans. The maximum depth of the excavations was 4 feet bgs. Six sidewall sample locations with chemical results above the project action levels were left in place to avoid comprising the structural integrity of adjacent buildings. Six Ra-226 samples with results counted by the on-site gamma spectroscopy lab with results exceeding the project screening criterion were also left in place. These samples were located along building foundations or at the edge of the project-specified excavation extent.
Previous and Ongoing Removal Actions		
Time-Critical Removal Action for Soil at IR Site 12	2015-2017	In October 2015, the Navy signed an action memorandum that documented its decision to undertake another removal action for soil at Site 12. The removal action will address petroleum contamination in the Gateview Arsenic/TPH Area and discrete locations of soil in the southern portion of Site 12. The Navy will excavate the petroleum contaminated soil in the Gateview Arsenic/TPH source area near Buildings 1311 and 1313 and will add a biostimulation compound to further treat the petroleum. The objective of this portion of the removal action is to remove and treat the residual petroleum that creates conditions conducive to reducing concentrations of arsenic that have leached from the soil into the groundwater. The Navy demolished Buildings 1311 and 1313 to reach the contaminated soil. In addition, the Navy excavated discrete locations of soil dispersed throughout the southern portion of Site 12. The Navy removed soil contaminated with lead, PAHs, PCBs, and dioxins and furans. The Navy demolished Buildings 1100, 1102, 1104, and 1106[2] to reach the contaminated soil. The removal action began in April 2016 and was completed in August 2017.
Phase III Non-Time-Critical Removal Action for PCBs, PAHs, Dioxin/Furans, Lead, and Ra-226 at SWDA Northpoint	2017	In 2017, the Navy undertook a non-time-critical removal action (NTCRA) at at SWDA North Point. The objective of the NTCRA was to address the residual material that exceeded the project screening criteria identified in the 2007 Phase I NTCRA, and to collect additional data to address data gaps enabling SWDA North Point to meet unrestricted radiological release requirements and chemical no further action status. Approximately 15,000 cubic yards was excavated. The maximum depth of the excavations was 4 feet bgs. The work was stopped due to lack of funding at the time.

SAP Worksheet #10 – Problem Definition (Continued)

Notes:
[1] The documents listed are available in the Administrative Record and provide detailed information used to support remedy selection at Site 12.
[2] In addition to Buildings 1100, 1102, 1104, and 1106, the following buildings have been demolished in Site 12: 1101, 1103, 1119, 1121, 1123, 1125, 1127, 1133, 1207, 1209, 1211, 1213, 1231, 1233, 1235, 1313, 1319, 1321, 1323, and 1325.

As described above, the *Final Feasibility Study Addendum for Installation Restoration Site 12, Old Bunker Area, Non-Solid Waste Disposal Area, Former Naval Station Treasure Island, San Francisco, California* (FS Addendum; KCH, 2015) outlines the nature and extent of contamination at Site 12 as summarized for this project in Section 10.4. The ROD/Final RAP (Navy, 2017) contains the details of the remedial action for the site as described for this project on Worksheet 17.

10.4 Nature and Extent of Contamination

As described in the ROD/Final RAP (Navy, 2017), the contamination at Site 12 resulted from waste disposal activities by the Navy previously identified on site and from existing debris that was not removed during housing construction. The chemicals potentially released at Site 12, including metals, dioxins and furans, PCBs and PAHs, are mostly attributed to waste disposal (including burning) activities by the Navy. The remedial action detailed in this SAP and RAWP is necessary to address potential risk to current and future residential receptors from dermal contact, ingestion, and inhalation of contaminants in soil. The remedial action will also address potential risk to off-site aquatic receptors in San Francisco Bay from arsenic-contaminated groundwater. (This portion of the remedial action was completed per the TCRA [CE2Kleinfelder, 2016] in 2017.)

A description of the components of the remedial action follow:

- 58 non-SWDA discrete excavations
    - 10 feet wide, 10 feet long, and depths to be determined based on Table 17-1.
- 2 building demolitions
    - Building 1126 (80 feet wide, 170 feet long); 4 feet of soil beneath the building is to be excavated.
    - Building 1217 (80 feet wide, 130 feet long); 4 feet of soil beneath the building is to be excavated.
    - Continuation of the excavation of the North Point SWDA NTCRA.

10.5 Remediation Goals

The COCs and their associated RGs are presented in Table 10-2. The values for the IR Site 12 non-SWDA remedial action COCs are taken from the ROD/Final RAP (Navy, 2017). The values for the North Point SWDA NTCRA COCs are the same as those for the non-SWDA remedial action. They are found in the Action Memorandum/ Interim Remedial Action Plan: Non-Time Critical Removal Action for Solid Waste Disposal Areas Installation Restoration Site 12 Old Bunker Area Naval Station Treasure Island San Francisco, California (Action Memo; Navy, 2007).

SAP Worksheet #10 – Problem Definition (Continued)

Table 10-2: Chemical Remediation Goals for Soil and Groundwater

Constituent	Remediation Goals	
	Soil (mg/kg)	Groundwater[1] (ug/L)
Lead	400	--
Total Chromium	280[2]	--
PAHs as BaP EQ	0.62	--
PCBs at total aroclors	1.0	--
Pesticide (4,4-DDD)	2.0[3]	--
Pesticide (alpha-BHC)	0.077[3]	--
Dioxins as 2,3,7,8-TCDD TEQ	12 ng/kg	--
Arsenic	N/A	36[4]

Notes:

1. TPH does not have a goal for groundwater. Qualitatively, the goal for dissolved TPH will be mass reduction via target cleanup goals in soil (including any measurable free product) to support the numeric remedial goal for arsenic in groundwater.
2. Total chromium is not a COC. However, the Navy will excavate isolated locations with an RBC goal of 280 mg/kg.
3. Pesticides (4,4-DDD and alpha-BHC) are not COCs. However, the Navy will excavate isolated locations with an RBC goal of 2.0 and 0.077, respectively.
4. Goal from Tier 1 Screening-Level Ecological Risk Assessment for Treasure Island (IR Sites 6, 12, 21, 24, 30 31, 32, and 33), Naval Station Treasure Island, San Francisco, California prepared by SulTech for U.S. Department of the Navy, BRAC PMO West, March 23.

Acronyms:

mg/kg	milligrams per kilogram	ug/L	micrograms per liter
ng/kg	nanograms per kilogram	RBC	risk-based concentration

The radionuclide of concern is Ra-226. Soil sampling will include confirming that soil concentrations are below the release criteria given in Table 10-3, which are from the revised Performance Work Statement for this task order dated May 4, 2017.

Table 10-3: Radiological Release Criteria for Ra-226

Materials Release Criteria	Table 3 of U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide 8.23, *Radiation Safety Surveys at Medical Institutions* (NRC, 1981)
Soil Screening Level[1]	1.0 picocuries per gram (pCi/g) plus background, or 1.69 pCi/g
Soil Release Criteria	RESRAD modeling using 12 millirem per year and/or site specific data
Water	Currently, there are no release criteria and/or screening levels for water.

[1] Statewide Radiation Protection Plan – Revision 1, Treasure Island, San Francisco, California (CB&I, 2014)

This remedial action/NTCRA will also include radiological controls, surveying, screening, potential object retrieval, characterization, and sampling to ensure worker(s) and community health and safety within the project area footprint(s) as is described in the Radiological Management and Demolition Plan.

SAP Worksheet #11 – Project Quality Objectives/Systematic Planning Process Statements

Step 1	**State the Problem**
IR Site 12 contains soil with concentrations of COCs above the PSLs (WS #15) which include PAHs, selected pesticides, PCBs, dioxin/furans, chromium, and/or lead. These COCs may potentially pose a risk to current and future Treasure Island residents and utility workers if not remediated. Radiological contamination has been detected in soil at IR Site 12 above the screening criteria (WS #15); confirmation sampling for radium-226 of excavations and radiological screening of excavated soils and removed buildings will be performed.	
Step 2	**Identify the Goals of the Study**
The goals of the sampling activities are: • Remove contaminated soil from the non-SWDA locations (SAP Worksheet # 18 and Figure 2), the footprints of Building 1126 and 1217 (Figure 2), and Northpoint SWDA (Figure 3). • Determine whether imported fill materials meet acceptance criteria presented on SAP Worksheet #15.6 through #15.14. • Document final concentrations of PAHs, selected pesticides, PCBs, dioxin/furans, chromium, lead, and/or radium-226 left-in-place in completed excavation areas (shown on Figure 2 and 3). • Supplement the existing dataset consisting of monitored natural attenuation (MNA) parameters in groundwater at the Gateview Arsenic/TPH area (Figure 4) with four quarters of sampling for TPH, radium-226, total and dissolved metals, total dissolved solids (TDS), total suspended solids (TSS), sulfate, and ferrous iron in monitoring wells as listed on SAP Worksheet #18 to be provided to the basewide groundwater monitoring contractor. • Collect radiological data representative of post-remedial action or "as-left" conditions of each excavation to better inform the IR Site 12 conceptual site model for non-SWDAs as to the presence and extent of radioactive contamination due to housing construction grading. • Collect radiological data representative of groundwater in the Gateview TPH/Arsenic area to support the planned Feasibility Study Addendum. The Study Questions Are: • Do imported fill materials meet the acceptance criteria? • Are concentrations of PAHs, selected pesticides, PCBs, dioxin/furans, chromium, lead, and/or radium-226 left-in-place below project screening limits (SAP Worksheet #15.1 through #15.6) after excavation? • Are TPH and geochemical parameter data from the Gateview Arsenic/TPH area wells (SAP Worksheet #18) of quality suitable for supporting the basewide MNA program?	

SAP Worksheet # 11 – Project Quality Objectives/Systematic Planning Process Statements (Continued)

Step 3 Identify Information Inputs

The following inputs will be used to make decisions for this project:

- Previous IR Site 12 soil sampling results that represent current in-place conditions, and the site-specific RAOs presented in the PWS.
- Post-excavation dioxin/furan, pesticide, PCB, PAH, lead, and chromium, and Ra-226 confirmation soil samples.
- Sampling of imported fill material per DTSC guidance (dependent on source of fill).
- Groundwater elevation and sampling data from 13 wells in the Gateview Arsenic/TPH area as listed on SAP Worksheet #18.

Step 4 Define the Boundaries of the Study

Figure 2, "IR Site 12 Non-SWDA Remedial Action Map," shows the estimated extent of excavations of the footprints of buildings 1126 and 1217 and the proposed discrete excavation areas. The total estimated volume with benching for all proposed excavations is 4,000 bank cubic yards (CY).

The Northpoint SWDA excavation area is located along the northern portion of Site 12 (Figure 3). The total estimated volume with benching for the excavations is 4,000 bank cubic yards (CY).

The project duration for the field activities of this RA is approximately 16 months, with excavation beginning and ending in September of 2018 and with groundwater monitoring completed in December 2019.

SAP Worksheet # 11 – Project Quality Objectives/Systematic Planning Process Statements (Continued)

Step 5	**Develop the Analytical Approach**

The decision rules for this RA are:

Excavation and Confirmation Sampling:

- If, after initial excavation, concentrations of BAP EQ, TCDD TEQ, selected pesticides, total Aroclors, chromium, lead, and/or Ra-226 in confirmation samples are below their respective PSLs (WS #15-1 through 15-6) (or for COCs, chromium, and selected pesticides where the PSL is less than the limit of quantitation [LOQ], the COC, chromium, or selected pesticide is not detected), at the excavation boundaries (perimeter and bottom), then those samples are considered final.
- If, after initial excavation, confirmation sample concentrations of BAP EQ, TCDD TEQ, selected pesticides, total Aroclors, chromium, lead, and/or Ra-226 are above their respective PSLs (WS #15-1 through 15-6) (or for COCs, chromium, and selected pesticides where the PSLs are less than the LOQ and the COC, chromium, or selected pesticide is detected between the detection limit [DL] and LOQ) at the excavation boundaries (perimeter or bottom), then step-out(s) and/or over-excavation will be performed and additional confirmation samples collected in accordance with the Work Plan and Worksheet #17.

Imported fill material:

- If the required sampling frequency meets the requirements outlined in the DTSC *Information Advisory Clean Imported Fill Material* and the results meet the acceptance criteria presented in Worksheets #15-6 through #15-14, then the source will be considered suitable for backfill.
- If the required sampling frequency does not meet the requirements outlined in the DTSC *Information Advisory Clean Imported Fill Material*, and/or results do not meet the acceptance criteria presented in Worksheets #15-6 through #15-14, then the source will not be considered suitable for backfill.

Groundwater Sampling at Gateview Arsenic/TPH Area:

- If the results of the dataset for the groundwater monitoring have been validated and are complete, then they will be transferred to the Navy for supplementing the basewide groundwater MNA dataset.
- If the concentrations of COCs exceed the project screening criteria as listed on WS #15.15 though WS #15.17, then the results will be used to delineate the extent of contamination and to support site evaluations during the preparation of the planned FS Addendum.

SAP Worksheet # 11 – Project Quality Objectives/Systematic Planning Process Statements (Continued)

Step 6	**Specify Performance or Acceptance Criteria**
To limit uncertainty in obtained environmental data, criteria for the precision, accuracy, representativeness, completeness, comparability, and sensitivity parameters and reporting limits for the chemicals of concern have been developed to meet the PSLs for the RA. Measurement errors will be controlled by using appropriate sampling and analytical methods, adhering to the Department of Defense (DoD) Quality Systems Manual (QSM) (version 5.1), following established SOPs, and having third-party data validation to verify laboratory processes. The field crews will review the SAP before sample collection to limit sample collection errors. The subcontract analytical laboratory will have a copy of the SAP and will adhere to DoD QSM guidance to limit measurement errors.	
Step 7	**Develop Plan for Obtaining Data**
A resource-effective plan for collecting data sufficient to fulfill study objective developed in Steps 1 through 6 of the DQO process is described in SAP Worksheet #17.	

SAP Worksheet #12 – Measurement Performance Criteria Table
(UFP-QAPP Manual Section 2.6.2)

Measurement Performance Criteria Table – Field QC Samples

Matrix: Soil

QC Sample[1]	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample (Assesses Error for Sampling [S], Analytical [A] or both [S&A])
Field Duplicate[1]	All	Not Applicable	Precision	Not Applicable	S & A
Equipment Rinse Blanks	Dioxin/Furans, VOCs, SVOCs/PAHs, TPH, Pesticides, PCBs, Metals	None if disposable sampling equipment used; 1 per day if using non-disposable sampling equipment	Accuracy/Bias – Contamination	< ½ limit of quantitation (LOQ)	S
Matrix Spikes[2]	Dioxin/Furans, Metals, VOCs, SVOCs/PAHs, PCBs, Pesticides, TPH	5%; one per 20 samples collected	Precision/Accuracy	Laboratory statistically derived control limits	A
Temperature Blanks[3]	Mercury, VOCs, SVOCs, PCBs, Pesticides, TPH, Cyanide	Every cooler shipped to the laboratory	Representativeness	< 6 degrees Celsius (ºC)	S

Notes:
[1] Due to the heterogeneous distribution of contaminants typically found in soil matrix, field duplicates for soil samples are not considered reliable for determining precision, and will not be collected for this project. Sample data are not qualified based on field duplicate precision; matrix spike duplicate or lab replicate data will be used to access sample precision.
[2]Per DoD QSM 5.1.1 Table B-17 matrix spikes are not required for gamma spectroscopy.
[3]There are no temperature preservation requirements for metals, radionuclides, or asbestos; therefore, no temperature blanks are required.

SAP Worksheet #12 – Measurement Performance Criteria Table (Continued)
(UFP-QAPP Manual Section 2.6.2)

Measurement Performance Criteria Table – Field QC Samples

Matrix: Water

QC Sample	Analytical Group[1]	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample (Assesses Error for Sampling [S], Analytical [A] or both [S&A])
Field Duplicate	TPH, Total and Dissolved Metals	10%	Precision	Relative percent difference (RPD) $\leq$ 40%	S & A
Trip Blank	TPH-g	1 per day	Representativeness	No analyte greater (>) than ½ LOQ	S & A
Equipment Blank	TPH, Total and Dissolved Metals	None if dedicated sampling equipment used; 1 per day if using non-dedicated sampling equipment	Accuracy/Bias – Contamination	< ½ limit of quantitation (LOQ)	S

Notes:
[1] Sulfate, TDS, and TSS are not COCs, have no screening criteria, and are being collected for informational purposes only. For this reason, no equipment blanks or field duplicates are necessary to achieve the data quality objectives for these parameters.

SAP Worksheet #13 – Secondary Data Criteria and Limitations Table

(UFP-QAPP Manual Section 2.7)

Secondary Data	**Data Source** (originating organization, report title and date)	**Data Generator(s)** (originating organization, data types, data generation / collection dates)	**How Data Will Be Used**	**Limitations on Data Use**
Historical Data	*Final Preliminary Assessment /Site Inspection (PA/SI), Naval Station Treasure Island, California. Prepared for Department of the Navy, Facilities Engineering Command, Naval Energy and Environmental Support Activity.* (April 1988)	Dames and Moore	Assessment of site conditions	None
Historical Data	*Final Phase III Non-Time Critical Removal Action, Solid Waste Disposal Areas, IR Site 12, Former Naval Station Treasure Island, San Francisco, California.* (June 2015)	CB&I	Assessment of site conditions	None.
Historical Data	*Final Post-Construction Summary Report, Non-Time Critical Removal Action for Bigelow Court, Solid Waste Disposal Area, IR Site 12, Former Naval Station Treasure Island, San Francisco, California.* (October 2015)	CB&I	Assessment of site conditions	None
Historical Data	*Final Feasibility Study for Installation Restoration Site 12, Old Bunker Area Non-Solid Waste Disposal Ares, Naval Station Treasure Island, San Francisco, California.* (March, 2014)	KCH	To guide work yet to be completed.	None

SAP Worksheet #13 – Secondary Data Criteria and Limitations Table

Secondary Data	**Data Source** (originating organization, report title and date)	**Data Generator(s)** (originating organization, data types, data generation / collection dates)	**How Data Will Be Used**	**Limitations on Data Use**
Historical Data	*Final Feasibility Study Addendum for Installation Restoration Site 12, Old Bunker Area Non-Solid Waste Disposal Ares, Naval Station Treasure Island, San Francisco, California.* (June 2015)	KCH	To guide work yet to be completed.	None
Design Plans	*Proposed Plan/Draft Remedial Action Plan, Former Naval Station Treasure Island, Installation Restoration Site 12 (Excluding Solid Waste Disposal Areas and the Radiological Program.* (March 2016)	Navy	To guide work yet to be completed.	None

SAP Worksheet #14 – Summary of Project Tasks
(UFP-QAPP Manual Section 2.8.1)

14.1 Major Sampling Tasks
Tasks applicable to sampling activities performed by Gilbane for this project at IR Site 12 will include the following:

- Collect pre-excavation confirmation samples to determine the extent of soil contamination prior to excavation.
- Construct and operate RSY pads.
- Excavate soil with PAH, Dioxin/Furan, selected pesticides, chromium, lead, and/or Ra-226 contamination above the PSLs and collect post-excavation confirmation samples.
- Backfill excavated areas with clean imported fill.
- Perform quarterly sampling of monitoring wells in Gateview Arsenic/TPH Area.
- Review and validate data, and upload to Naval Installation Restoration Information Solutions (NIRIS).

14.1.1 Sample Collection Procedures
The following sections provide the sampling procedures for collection of samples associated with remediation activities for this project. Samples will be labeled, documented, and packaged according to procedures in SAP Worksheets #27 and 29. The types of samples to be collected are listed below:

Excavation Soil Samples
Soil samples will be collected from excavation sidewalls and bottom using disposable plastic scoops in accordance with Gilbane SOP PR-TC-02.02.01.01 (Attachment A). Samples will be collected either directly from shallow excavations or from the backhoe/excavator bucket using the general sampling technique described below:

1. Put on a new (unused) pair of sampling gloves and other appropriate personal protective equipment (PPE).
2. Obtain a new (unused) disposable sampling scoop (or other non-disposable decontaminated sampling equipment).
3. If the excavation is less than 4 feet in depth or is sloped, the excavation may be entered for sample collection.
4. If the excavation is greater than 4 feet and un-sloped, then the excavation will not be entered for sampling. Direct the backhoe operator to obtain a sample from the desired location. Allow excess water, if present, to drain from the soil before collecting the sample.
5. Collect the sample for the remaining analysis into the appropriate sample containers using a disposable sampling scoop. Sample containers are listed in SAP Worksheet #19.
6. Label, package, and prepare the samples for shipment to the laboratory in accordance with SOP PR-TC-02.04.01.01 (Attachment A).

SAP Worksheet #14 – Summary of Project Tasks (Continued)

7. Place the chemistry samples in an ice-filled cooler in accordance with SOP PR-TC-02.04.01.01 (Attachment A) after collection.

Terra Core® Soil Samples for Imported Fill Material Samples
Soil samples for VOC or TPH-p analyses will be collected using TerraCore sampling devices (or equivalent) following the procedure described in Gilbane SOP PR-TC-02.02.01.05 (Attachment A).

All samples will be documented, handled, and shipped in accordance with the provisions set forth by Worksheet #27.

Groundwater Elevation Measurements
Groundwater elevation measurements will be collected prior to groundwater sample collection in accordance with Gilbane SOP PR-TC-02.03.09.00 (Attachment A).

Groundwater Sampling Procedure
Groundwater sampling will be conducted using the low-flow technique in accordance with Gilbane SOP PR-TC-02.02.02.03 (Attachment A). Each well will be analyzed for the parameters listed on WS #18, in addition to the following field parameters: pH, temperature, conductivity, turbidity, oxidation-reduction potential (ORP), dissolved oxygen, and ferrous iron.

Dedicated bladder pumps are installed for most wells with a diameter larger than 1-inch. If the well does not have a dedicated pump, or the pump is not functional, then a decontaminated portable pump will be installed and lowered to the appropriate depth. The depth will be recorded on the sampling form (an example of which is found as an attachment to SOP PR-TC-02.02.02.03). If the well diameter will not accommodate a bladder pump, a peristaltic pump may be used to sample the well.

14.1.2 Decontamination Procedures
Prior to decontamination, non-disposable sampling equipment will be wiped down and radiologically surveyed. Total radioactivity will be measured using a hand-held alpha/beta survey meter. A smear sample will be collected and analyzed for removable radioactivity. If radioactivity exceeding the release limits shown below in Table 14-1 is detected, the sampling equipment will be wiped down again and re-surveyed.

Table 14-1

Type of Radiation	Removable (disintegrations per minute [dpm]/100cm^2	Total (dpm/100cm^2)
Alpha	20	100
Beta	1,000	5,000

Note: To eliminate the need for isotopic identification, alpha radioactivity is assumed to be Ra-226. An industry-standard default value is used for beta radioactivity since there are no beta-emitting ROCs.

SAP Worksheet #14 – Summary of Project Tasks (Continued)

Once radioactivity is below the release limits, the non-disposable sampling equipment that comes into contact with samples will be decontaminated to prevent the introduction of extraneous material into samples, and to prevent cross-contamination between samples. All equipment will be decontaminated by steam cleaning or by washing with a non-phosphate detergent such as Liquinox™ or equivalent. Decontamination water will be collected in 55-gallon U.S. Department of Transportation (DOT)-approved drums or a poly tank and handled as liquid waste in accordance with the Waste Management Plan.

The following procedures will be used to decontaminate non-disposable sampling equipment:

1. If mud or soil is adhering to the sampling equipment, first rinse with potable water. This step will decrease the gross contamination and reduce the frequency at which the non-phosphate detergent and water solution need to be changed.

2. Wash with the non-phosphate detergent and water solution. This step will remove remaining contamination from the equipment. Dilute the non-phosphate detergent as directed by the manufacturer.

3. Rinse with potable water. Change the water frequently.

4. Rinse twice with deionized water. This step will rinse any detergent solution and potable water residues. Rinsing will be done by applying the deionized water from a clean squeeze bottle (or equivalent) while holding equipment over a bucket.

5. Store unused decontaminated equipment in plastic or designated storage container to prevent contamination until next use.

14.4 Post-Sampling Field Tasks

Waste characterization and disposal will be performed as detailed in the Waste Management Plan (Appendix B of the RAWP). Site restoration and surveying will be performed as detailed in Section 8.1, and Section 6.0, respectively, of the project RAWP.

14.2 Analytical Tasks

The handling of the samples and transferring of custody must be well documented given the evidentiary nature of the analytical data. The integrity and traceability of samples from the time they are collected through the time the data are reported are essential in any sampling and analysis program. Sample custody and procedures are described in WS #27. Sampling locations and analytical methods are described further in WS #18 through #20.

14.3 Quality Control Tasks

Analytical methods will require the applicable QC tasks described in the respective methods and DoD QSM 5.1.1, including initial calibrations, continuing calibrations, tuning, reagent blanks, surrogates, replicates, control spikes, and others, as necessary.

Media-specific field quality control samples (as described on SAP Worksheet #12) include field duplicates to assess sampling and analytical precision, as well as trip blanks

SAP Worksheet #14 – Summary of Project Tasks (Continued)

and equipment blanks to assess sampling and analytical accuracy.

14.4 Data Management and Review Tasks

Analytical data generated by the fixed analytical laboratory will be reviewed by the laboratory using three levels of document review and reporting. Review processes will be documented using appropriate checklists, forms, or logbooks, which will be signed and dated by the reviewers. Field surveying data, field forms, and chain-of-custody (COC) records will be reviewed by the PQCM and/or the Project Chemist and maintained in the Gilbane project file in accordance with Gilbane standard operating procedure (SOP) PR-TC-01.04.01.00, Field Documentation.

The Site Superintendent or PQCM will e-mail a copy of the COC records to the Project Chemist the day any samples are sent to the laboratory. The Project Chemist will maintain a copy of the COC record until submitted to the Navy Administrative Record along with the hard-copy packages as described in SAP Worksheet #29. The laboratory will e-mail definitive analytical results within the turnaround time to the Project Chemist. This submittal will include surrogates, and matrix spike/matrix spike duplicates (MS/MSDs). The Project Chemist will review prior to distribution to the project team. Following this submittal, the laboratory will be required to submit a DoD Stage 2A-, 2B- or 4-suitable data packages package within 10 business days of the sample collection date as described in SAP Worksheet #29.

Information from the COC records for samples analyzed by the laboratory will be uploaded into a database following the procedures outlined in Gilbane SOP PC-TR-02.12.02.00, Sample Tracking and Electronic Data Management. The laboratories will provide electronic data deliverables (EDDs) in order to upload analytical results into the Gilbane database. The EDD will be checked for required values and project-specific requirements. Any discrepancies in the EDD will be corrected by the laboratory. Validated results will be exported for upload to NIRIS in accordance with Environmental Work Instruction (EWI) #6, Environmental Data Management and Required Electronic Delivery Standards (U.S. Navy, Southwest Division [SWDIV], 2005). The database will be backed up on electronic media or an independent server.

Survey data will be recorded by on-site personnel for all sample locations. Horizontal control information for upload into the database will be captured in the State Plane Coordinate System in feet, and vertical control standards will be in mean sea level. Survey data for upload into the NIRIS will be in accordance with EWI #6, (SWDIV, 2005).

DoD Stage 2B and Stage 4 hard-copy data packages will be stored until subsequent submittal to the Navy Administrative Record as described in SAP Worksheet #29.

14.5 Third Party Data Validation

Analytical results that represent definitive data will be validated by a third-party data validation service provider. The validation report is described in SAP Worksheet #29, and the validation qualifiers will be entered electronically in the Gilbane project database by the validator to the EDDs loaded by the laboratory.

SAP Worksheet #15.1 – Reference Limits and Evaluation Table

(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil
Analytical Group: Polycyclic Aromatic Hydrocarbons (PAHs) by EPA 8270DSIM

Analyte	Chemical Abstracts Service (CAS) Number	Project Screening Limit[2] (mg/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific		
					LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
Acenaphthene	80-23-9	NA	NA	0.0066	0.005	0.001	0.00047
Anthracene	120-12-7	NA	NA	0.0066	0.005	0.001	0.000395
Benzo(a)anthracene	56-55-3	NA	NA	0.0066	0.005	0.001	0.000303
Benzo(a)pyrene	50-32-8	NA	NA	0.0066	0.005	0.001	0.000399
Benzo(b)fluoranthene	205-99-2	NA	NA	0.0066	0.005	0.002	0.000505
Benzo(k)fluoranthene	207-08-9	NA	NA	0.0066	0.005	0.002	0.000760
Benzo(g,h,i)perylene	191-24-2	NA	NA	0.0066	0.005	0.003	.00100
Chrysene	218-01-9	NA	NA	0.0066	0.005	0.001	0.000347
Dibenz(a,h)anthracene	53-70-3	NA	NA	0.0066	0.005	0.003	0.00120
Fluoranthene	206-44-0	NA	NA	0.0066	0.005	0.001	0.000293
Fluorene	86-73-7	NA	NA	0.0066	0.005	0.001	0.00049
Indeno(1,2,3-cd)pyrene	193-39-5	NA	NA	0.0066	0.005	0.001	0.000479
Naphthalene	91-20-3	NA	NA	0.0066	0.005	0.001	0.000307
Pyrene	129-00-0	NA	NA	0.0066	0.005	0.001	0.000350
PAHs as BAP (EQ)[2]	NL	0.62	TI RBC[1]	NA	NA	NA	NA

Notes:
[1] TI RBC = Treasure Island residential risk-based concentration from the IR Site 12 RI report (TriECo-Tt, 2012)
[2]PAHs as benzo(a)pyrene equivalency [BAP (EQ)] will be calculated as described on Worksheet 17.2.
[3]Results will be reported on a dry-weight basis for comparison to the project action limits.
mg/kg = milligrams per kilogram
NA = not applicable
NL = not listed

SAP Worksheet #15.2 – Reference Limits and Evaluation Table

(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil
Analytical Group: Dioxin/Furans by EPA Method 8290

Analyte	Chemical Abstracts Service (CAS) Number	Project Screening Limit[2] (ng/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (ng/kg)	Laboratory-specific		
					LOQ (ng/kg)	LOD (ng/kg)	DL (ng/kg)
2,3,7,8-TCDD	1746-01-6	NA	NA	1	1	0.40	0.15
1,2,3,7,8-PeCDD	40321-76-4	NA	NA	5	5	0.75	0.30
1,2,3,4,7,8-HxCDD	39277-28-6	NA	NA	5	5	2.0	0.71
1,2,3,6,7,8-HxCDD	57653-85-7	NA	NA	5	5	2.0	0.58
1,2,3,7,8,9-HxCDD	19408-74-3	NA	NA	5	5	2.0	0.58
1,2,3,4,6,7,8-HpCDD	35822-39-4	NA	NA	5	5	1.0	0.46
OCDD	3268-87-9	NA	NA	10	10	4.0	1.5
2,3,7,8-TCDF	51207-31-9	NA	NA	1	1	0.40	0.11
1,2,3,7,8-PeCDF	57117-41-6	NA	NA	5	5	0.75	0.27
2,3,4,7,8-PeCDF	57117-31-4	NA	NA	5	5	0.75	0.29
1,2,3,4,7,8-HxCDF	70648-26-9	NA	NA	5	5	0.75	0.30
1,2,3,6,7,8-HxCDF	57117-44-9	NA	NA	5	5	1.0	0.38
1,2,3,7,8,9-HxCDF	72918-21-9	NA	NA	5	5	1.0	0.43
2,3,4,6,7,8-HxCDF	60851-34-5	NA	NA	5	5	0.75	0.30
1,2,3,4,6,7,8-HpCDF	67562-39-4	NA	NA	5	5	1.0	0.38
1,2,3,4,7,8,9-HpCDF	55673-89-7	NA	NA	5	5	2.0	0.65
OCDF	39001-02-0	NA	NA	10	10	4.0	1.2
Dioxins as 2,3,7,8-TCDD TEQ	NL	12	TI Ambient Level[1]	NA	NA	NA	NA

Notes:
[1] TriEco-Tt, 2012. Final Remedial Investigation for IR Site 12 Naval Station Treasure Island San Francisco, California. June. The 2,3,7,8-TCDD TEQ (Dioxin TEQ) is based on the 2,3,7,8-TCDD congener and is calculated as described in Worksheet 17.

SAP Worksheet #15.2 – Reference Limits and Evaluation Table (Continued)

[2]Results will be reported on a dry-weight basis for comparison to the project action limits.

ng/kg = nanograms per kilogram
DL = detection limit
EMPC = estimated maximum potential concentration
HpCDD = heptachlorodibenzo-p-dioxin
HpCDF = heptachlorodibenzofuran
HxCDD = hexachlorodibenzo-p-dioxin
HxCDF = hexachlorodibenzofuran
LOD = limit of detection
NA = not applicable
NL = not listed
OCDF = octachlorodibenzofuran
PeCDD = pentachlorodibenzo-p-dioxin
PeCDF = pentachlorodibenzofuran
QL = quantitation limit
TCDD = tetrachlorodibenzo-p-dioxin
TCDF = tetrachlorodibenzofuran

SAP Worksheet #15.3 – Reference Limits and Evaluation Table

(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil
Analytical Group: Pesticides by EPA Method 8081B

Analyte	Chemical Abstracts Service (CAS) Number	Project Screening Limit[3] (mg/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific		
					LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
Alpha-BHC	319-84-6	0.077	TI RBC[2]	0.04	0.00170	0.0005	0.000220
4,4-DDD	72-54-8	2.0	TI RBC[2]	1.0	0.00170	0.0005	0.000260

Notes:
[1] Pesticides (4,4-DDD and alpha-BHC) are not COCs. However, the Navy will excavate isolated locations with the TI RBC goals presented above.
[2]TI RBC = Treasure Island residential risk-based concentration from the IR Site 12 RI report (TriECo-Tt, 2012).
[3]Results will be reported on a dry-weight basis for comparison to the project action limits.
mg/kg = milligrams per kilogram

SAP Worksheet #15.4 – Reference Limits and Evaluation Table
(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil
Analytical Group: PCBs by EPA 8082A

Analyte	Chemical Abstracts Service (CAS) Number	Project Screening Limit[3] (mg/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific		
					LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
Aroclor 1016	12674-11-2	NA	NA	0.033	0.033	0.01	0.0034
Aroclor 1221	11104-28-2	NA	NA	0.033	0.033	0.015	0.0052
Aroclor 1232	11141-16-5	NA	NA	0.033	0.033	0.02	0.0064
Aroclor 1242	53469-21-9	NA	NA	0.033	0.033	0.02	0.0074
Aroclor 1248	12672-29-6	NA	NA	0.033	0.033	0.015	0.0057
Aroclor 1254	11097-69-1	NA	NA	0.033	0.033	0.01	0.0027
Aroclor 1260	11096-82-5	NA	NA	0.033	0.033	0.010	0.0029
Total Aroclors[1]	NL	1.0	TI RBC[2]	NA	NA	NA	NA

Notes:
[1] Total Aroclors will be calculated by summation of the seven listed Aroclors. Non-detected values will be included in the sum as one-half the value of the LOD.
[2] TI RBC = Treasure Island residential risk-based concentration from the IR Site 12 RI report (TriECo-Tt, 2012).
[3]Results will be reported on a dry-weight basis for comparison to the project action limits.
DL = detection limit
LOD = limit of detection
LOQ = limit of quantitation
NA = not applicable
NL = not listed
mg/kg = milligram per kilogram
PCB = polychlorinated biphenyls

SAP Worksheet #15.5 – Reference Limits and Evaluation Table
(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil
Analytical Group: Metals by EPA Method 6010C

Analyte	Chemical Abstracts Service (CAS) Number	Project Screening Limit[3] (mg/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific		
					LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
Total Chromium	7440-47-3	280	TI RBC[1]	140	1.00	0.750	0.250
Lead	7439-92-1	400	TI RBC[1]	200	1.00	0.75	0.250

Notes:
[1] TI RBC = Treasure Island residential risk-based concentration from the IR Site 12 RI report (TriECo-Tt, 2012)
[2]Total Chromium is not a COC. However, the Navy will excavate isolated locations with the TI RBC goal presented above.
[3]Results will be reported on a dry-weight basis for comparison to the project action limits.

DL= detection limit

LOD = limit of detection

LOQ = limit of quantitation

mg/kg = milligram per kilogram

SAP Worksheet #15.6 – Reference Limits and Evaluation Table

(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil (Imported fill material and Confirmation)

Analytical Group: Radium-226 by EPA 901.1M

Analyte[1]	CAS Number	Project Screening Limit[2] (pCi/g)	Project Screening Limit Reference	Project Quantitation Limit Goal (pCi/g)	Laboratory-specific MDC (pCi/g)
Radium-226	13982-63-3	1.69	Statewide Radiation Protection Plan[3]	0.5	0.5

Notes:

[1] Radium-226 will be reported based on the 609 keV bismuth-214 gamma energy peak after 21-day in-growth.
[2] Project Screening level is background plus the derived concentration guideline level (DCGL).
[3] *Statewide Radiation Protection Plan – Revision 1, Treasure Island, San Francisco, California* (CB&I, 2014)
keV = kilo-electron volts
MDC = minimum detectable concentration
NA = not applicable
MDL = method detection limit
RG = remediation goal
ROD = Record of Decision
pCi/g = picocuries per gram

SAP Worksheet #15.7 – Reference Limits and Evaluation Table
(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil (testing of imported fill material)
Analytical Group: VOCs by EPA Method 8260C

Analyte	CAS Number	Project Screening Limit[4] (mg/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific		
					LOQ (mg/kg)	**LOD** (mg/kg)	**DL** (mg/kg)
1,1,1,2-Tetrachloroethane	630-20-6	2.0	HERO HHRA Note 3[2]	1	0.005	0.001	0.000410
1,1,1-Trichloroethane	71-55-6	8,100	EPA Residential RSL[1]	4,000	0.005	0.001	0.00036
1,1,2,2-Tetrachloroethane	79-34-5	0.61	HERO HHRA Note 3[2]	0.3	0.005	0.002	0.000680
1,1,2-Trichloroethane	79-00-5	1.1	EPA Residential RSL[1]	0.5	0.005	0.001	0.000440
1,1-Dichloroethane	75-34-3	3.6	HERO HHRA Note 3[2]	1.3	0.005	0.001	0.00029
1,1-Dichloroethene	75-35-4	230	EPA Residential RSL[1]	100	0.005	0.001	0.00026
1,2,3-Trichlorobenzene	87-61-6	63	HERO HHRA Note 3[2]	30	0.005	0.002	0.00075
1,2,4-Trichlorobenzene	120-82-1	24	EPA Residential RSL[1]	12	0.005	0.002	0.00075
1,2,4-Trimethylbenzene	95-63-6	300	EPA Residential RSL[1]	150	0.005	0.002	0.000510
1,2-Dibromo-3-chloropropane	96-12-8	0.0053	EPA Residential RSL[1]	0.005	0.010	0.002	0.00088
1,2-Dibromoethane (EDB)	106-93-4	0.036	EPA Residential RSL[1]	0.018	0.010	0.001	0.00027
1,2-Dichlorobenzene	95-50-1	1,800	EPA Residential RSL[1]	900	0.005	0.002	0.00064
1,2-Dichloroethane	107-06-2	0.46	EPA Residential RSL[1]	0.23	0.005	0.002	0.000730
1,2-Dichloropropane	78-87-5	2.5	EPA Residential RSL[1]	1.2	0.005	0.002	0.000600
1,3,5-Trimethylbenzene	108-67-8	270	EPA Residential RSL[1]	130	0.005	0.001	0.00035
1,3-Dichloropropane	142-28-9	1,600	EPA Residential RSL[1]	800	0.005	0.002	0.000570
1,3-Dichlorobenzene	541-73-1	16	TI SSC[3]	8	0.005	0.001	0.00030
1,4-Dichlorobenzene	106-46-7	2.6	EPA Residential RSL[1]	1.3	0.005	0.002	0.00078
2-Butanone	78-93-3	27,000	EPA Residential RSL[1]	13,000	0.010	0.005	0.0014
2-Chlorotoluene	95-49-8	480	HERO HHRA Note 3[2]	200	0.005	0.002	0.00062
2-Hexanone	591-78-6	200	EPA Residential RSL[1]	100	0.010	0.002	0.00074
4-Chlorotoluene	106-43-4	440	HERO HHRA Note 3[2]	200	0.005	0.002	0.00086
4-Methyl-2-pentanone	108-10-1	33,000	EPA Residential RSL[1]	15,000	0.010	0.002	0.000920
Acetone	67-64-1	61,000	EPA Residential RSL[1]	30,000	0.020	0.005	0.0014

SAP Worksheet #15.7 – Reference Limits and Evaluation Table (Continued)

Matrix: Soil (testing of imported fill material)
Analytical Group: VOCs by EPA Method 8260C

Analyte	CAS Number	Project Screening Limit[4] (mg/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific		
					LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
Benzene	71-43-2	0.33	HERO HHRA Note 3[2]	0.015	0.005	0.001	0.00026
Bromobenzene	108-86-1	290	EPA Residential RSL[1]	150	0.005	0.002	0.00052
Bromochloromethane	74-97-5	150	EPA Residential RSL[1]	75	0.005	0.002	0.00094
Bromodichloromethane	75-27-4	0.30	HERO HHRA Note 3[2]	0.15	0.005	0.002	0.000530
Bromoform	75-25-2	20	HERO HHRA Note 3[2]	10	0.005	0.001	0.004
Bromomethane	74-83-9	6.8	EPA Residential RSL[1]	3.4	0.005	0.002	0.00086
Carbon disulfide	75-15-0	770	EPA Residential RSL[1]	330	0.01	0.001	0.00049
Carbon tetrachloride	56-23-5	0.099	HERO HHRA Note 3[2]	0.005	0.005	0.002	0.00053
Chlorobenzene	108-90-7	280	EPA Residential RSL[1]	140	0.005	0.001	0.00026
Chloroform	67-66-3	0.32	EPA Residential RSL[1]	0.15	0.005	0.001	0.00026
Chloromethane	74-87-3	110	EPA Residential RSL[1]	50	0.005	0.001	0.0005
cis-1,2-Dichloroethene	156-59-2	19	HERO HHRA Note 3[2]	10	0.005	0.002	0.00089
cis-1,3-Dichloropropene	10061-01-5	1.8	EPA Residential RSL[1]	0.9	0.005	0.002	0.000641
Dibromochloromethane	124-48-1	8.3	EPA Residential RSL[1]	4.0	0.005	0.001	0.00026
Dibromomethane	74-95-3	24	EPA Residential RSL[1]	12	0.005	0.002	0.00058
Dichlorodifluoromethane (Freon 12)	75-71-8	87	EPA Residential RSL[1]	43	0.005	0.002	0.00089
Ethylbenzene	100-41-4	5.8	EPA Residential RSL[1]	2.0	0.005	0.001	0.00034
Hexachlorobutadiene	87-68-3	1.2	HERO HHRA Note 3[2]	0.6	0.005	0.001	0.00033
Methyl tert-Butyl ether (MTBE)	1634-04-4	47	EPA Residential RSL[1]	23	0.005	0.002	0.0006
Methylene chloride	75-09-2	1.9	HERO HHRA Note 3[2]	1.0	0.005	0.002	0.00084
m,p-Xylenes	179601-23-1	550	EPA Residential RSL[1]	275	0.005	0.002	0.00081
o-Xylene	95-47-6	650	EPA Residential RSL[1]	325	0.005	0.001	0.00033
Styrene	100-42-5	6,000	EPA Residential RSL[1]	3,000	0.005	0.001	0.00031
Tetrachloroethene	127-18-4	0.59	HERO HHRA Note 3[2]	0.30	0.005	0.002	0.00061

SAP Worksheet #15.7 – Reference Limits and Evaluation Table (Continued)

Matrix: Soil (testing of imported fill material)
Analytical Group: VOCs by EPA Method 8260C

Analyte	CAS Number	Project Screening Limit[4] (mg/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific		
					LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
Toluene	108-88-3	1,100	HERO HHRA Note 3[2]	500	0.005	0.002	0.00061
trans-1,2-Dichloroethene	156-60-5	1,300	HERO HHRA Note 3[2]	600	0.005	0.001	0.00038
Trichloroethene	79-01-6	0.94	EPA Residential RSL[1]	0.45	0.005	0.002	0.0006
Trichlorofluoromethane	75-69-4	1,200	HERO HHRA Note 3[2]	600	0.005	0.001	0.00034
Vinyl chloride	75-01-4	0.0088	HERO HHRA Note 3[2]	0.005	0.005	0.001	0.00036

Notes:
[1] Values are from the EPA Region 9 Regional Screening Level for Residential Soil as presented in Regional Screening Level (RSL) Summary Table (TR=1E-6, HQ=1) May 2018.
[2] Values are from the Human and Ecology Risk Office (HERO) Human Health Risk Assessment (HHRA) Note 3 (DTSC, 2018).[3] TI SSC established for TI remediation projects (Shaw Environmental, Inc., 2005).
[4]Results will be reported on a dry-weight basis for comparison to the project screening limits.
DL = detection limit
LOD = limit of detection
LOQ = limit of quantitation
mg/kg = milligram per kilogram
RSL = Regional Screening Level

SAP Worksheet #15.8 – Reference Limits and Evaluation Table
(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil (testing of imported fill material)
Analytical Group: SVOCs by EPA Method 8270D with PAHs by 8270DSIM

Analyte	CAS Number	Project Screening Limit[4] (mg/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific		
					LOQ (mg/kg)	**LOD** (mg/kg)	**DL** (mg/kg)
2,4,5-Trichlorophenol	95-95-4	6,300	EPA Residential RSL[1]	3,200	0.330	.167	0.0830
2,4,6-Trichlorophenol	88-06-2	75	HERO HHRA Note 3[2]	35	0.330	0.167	0.0840
2,4-Dichlorophenol	120-83-2	190	EPA Residential RSL[1]	95	0.330	0.167	0.0890
2,4-Dimethylphenol	105-67-9	1,300	EPA Residential RSL[1]	650	0.500	0.333	0.167
2,4-Dinitrophenol	51-28-5	130	EPA Residential RSL[1]	65	2.00	0.333	0.214
2,4-Dinitrotoluene	121-14-2	1.7	EPA Residential RSL[1]	0.85	0.330	0.167	0.0890
2,6-Dinitrotoluene	606-20-2	0.36	EPA Residential RSL[1]	0.33	0.330	0.167	0.0990
2-Chloronaphthalene	91-58-7	4,800	EPA Residential RSL[1]	2,400	0.330	0.167	0.0810
2-Chlorophenol	95-57-8	390	EPA Residential RSL[1]	190	0.330	0.167	0.0880
2-Methylnaphthalene	91-57-6	240	EPA Residential RSL[1]	120	0.330	0.167	0.0850
2-Methylphenol	95-48-7	3,200	EPA Residential RSL[1]	1,600	0.330	0.167	0.0580
2-Nitroaniline	88-74-4	630	EPA Residential RSL[1]	310	1.60	0.333	0.0840
3,3'-Dichlorobenzidine	91-94-1	1.2	HERO HHRA Note 3[2]	1.6[5]	1.60	0.167	0.0940
3/4-Methylphenol	15831-10-4	3,200	EPA Residential RSL[1]	1,600	1.00	0.660	0.330
4-Chloroaniline	106-47-8	2.7	EPA Residential RSL[1]	1.3	0.330	0.167	0.0580
4-Nitroaniline	100-01-6	27	EPA Residential RSL[1]	13	1.60	0.167	0.0880
Acenaphthene (PAH)	83-32-9	3,600	EPA Residential RSL[1]	1800	0.005	0.001	0.00047
Anthracene (PAH)	120-12-7	18,000	EPA Residential RSL[1]	9,000	0.005	0.001	0.000395
Benzo(a)anthracene (PAH)	56-55-3	1.1	EPA Residential RSL[1]	0.5	0.005	0.001	0.000303
Benzo(a)pyrene (PAH)	50-32-8	0.11	EPA Residential RSL[1]	0.05	0.005	0.001	0.000399
Benzo(b)fluoranthene (PAH)	205-99-2	1.1	EPA Residential RSL[1]	0.5	0.005	0.002	0.000505
Benzo(k)fluoranthene (PAH)	207-08-9	11	EPA Residential RSL[1]	5.5	0.005	0.002	0.00076
Benzoic acid	65-85-0	250,000	EPA Residential RSL[1]	125,000	1.60	0.660	0.289
Benzyl alcohol	100-51-6	6,300	EPA Residential RSL[1]	3,000	0.510	0.367	0.170
bis(2-Chloroethoxy)methane	111-91-1	190	EPA Residential RSL[1]	95	0.330	0.167	0.0880
bis(2-Chloroethyl)ether	111-44-4	0.23	EPA Residential RSL[1]	0.33[5]	0.330	0.167	0.0810

SAP Worksheet #15.8 – Reference Limits and Evaluation Table (Continued)

Matrix: Soil (testing of imported fill material)
Analytical Group: SVOCs by EPA Method 8270D with PAHs by 8270DSIM

Analyte	CAS Number	Project Screening Limit[4] (mg/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific		
					LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
bis(2-Ethylhexyl)phthalate	117-81-7	39	EPA Residential RSL[1]	19	0.330	0.167	0.098
Chrysene (PAH)	218-01-9	110	EPA Residential RSL[1]	55	0.005	0.001	0.000347
Dibenz(a,h)anthracene (PAH)	53-70-3	0.11	EPA Residential RSL[1]	0.05	0.005	0.003	0.00120
Dibenzofuran	132-64-9	73	EPA Residential RSL[1]	35	0.330	0.167	0.0860
Diethylphthalate	84-66-2	51,000	EPA Residential RSL[1]	25,000	0.330	0.167	0.090
Dimethylphthalate	131-11-3	100,000	TI SSC[3]	50,000	0.330	0.167	0.087
Di-n-butylphthalate	84-74-2	6,300	EPA Residential RSL[1]	3,200	0.330	0.167	0.097
Di-n-octylphthalate	117-84-0	6,300	EPA Residential RSL[1]	3,200	0.330	0.167	0.097
Fluoranthene (PAH)	206-44-0	2,400	EPA Residential RSL[1]	1,200	0.005	0.001	0.000293
Fluorene (PAH)	86-73-7	2,400	EPA Residential RSL[1]	1,200	0.005	0.001	0.000490
Hexachlorobenzene	118-74-1	0.21	EPA Residential RSL[1]	0.33[5]	0.330	0.167	0.089
Hexachlorobutadiene	87-68-3	1.2	EPA Residential RSL[1]	0.6	0.330	0.167	0.082
Hexachloroethane	67-72-1	1.8	EPA Residential RSL[1]	0.9	0.330	0.167	0.0810
Indeno(1,2,3-cd)pyrene (PAH)	193-39-5	1.1	EPA Residential RSL[1]	0.5	0.005	0.001	0.000479
Isophorone	78-59-1	570	EPA Residential RSL[1]	280	0.330	0.167	0.093
Naphthalene (PAH)	91-20-3	3.8	EPA Residential RSL[1]	1.9	0.005	0.001	0.000307
Nitrobenzene	98-95-3	5.1	EPA Residential RSL[1]	2.5	0.330	0.167	0.076
n-Nitrosodiphenylamine	86-30-6	1,100	EPA Residential RSL[1]	550	0.330	0.167	0.096
Pentachlorophenol	87-86-5	1.0	EPA Residential RSL[1]	1.6[5]	1.60	0.167	0.0510
Phenol	108-95-2	19,000	EPA Residential RSL[1]	9,500	0.330	0.167	0.083
Pyrene (PAH)	129-00-0	1,800	EPA Residential RSL[1]	900	0.005	0.001	0.00035

Notes:
[1] Values are from the EPA Region 9 Regional Screening Level for Residential Soil as presented in Regional Screening Level (RSL) Summary Table (TR=1E-6, HQ=1) May 2018.
[2] Values are from the Human and Ecology Risk Office (HERO) Human Health Risk Assessment (HHRA) Note 3 (DTSC, 2018).
[3] TI SSC established for TI remediation projects (Shaw Environmental, Inc., 2005).
[4] Results will be reported on a dry-weight basis for comparison to the project action limits.
[5] The LOQ does not meet the PAL; however, the LOD and DL are sufficient to meet the PAL. Non-detects will be reported to the LOD.

SAP Worksheet #15.8 – Reference Limits and Evaluation Table

(UFP-QAPP Manual Section 2.8.1)

Notes (Continued):
DL= detection limit
EPA = U.S. Environmental protection Agency
LOD = limit of detection
LOQ = limit of quantitation
mg/kg = milligram per kilogram
PAH = polycyclic aromatic hydrocarbons
RSL = regional screening level

SAP Worksheet #15.9 – Reference Limits and Evaluation Table
(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil (testing of imported fill material)
Analytical Group: PCBs by EPA Method 8082A

Analyte	CAS Number	Project Screening Limit[2] (mg/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific		
					LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
Aroclor 1016	12674-11-2	4.1	EPA Residential RSL[1]	2.0	0.033	0.0100	0.0034
Aroclor 1221	11104-28-2	0.2	EPA Residential RSL[1]	0.1	0.033	0.0150	0.0052
Aroclor 1232	11141-16-5	0.17	EPA Residential RSL[1]	0.08	0.033	0.0200	0.0064
Aroclor 1242	53469-21-9	0.23	EPA Residential RSL[1]	0.12	0.033	0.0200	0.0074
Aroclor 1248	12672-29-6	0.23	EPA Residential RSL[1]	0.12	0.033	0.0150	0.0057
Aroclor 1254	11097-69-1	0.24	EPA Residential RSL[1]	0.12	0.033	0.0100	0.0027
Aroclor 1260	11096-82-5	0.24	EPA Residential RSL[1]	0.12	0.033	0.010	0.0029

Notes:
[1] Values are from the EPA Region 9 Regional Screening Level for Residential Soil as presented in Regional Screening Level (RSL) Summary Table (TR=1E-6, HQ=1) May 2018.
[2] Results will be reported on a dry-weight basis for comparison to the project action limits.
EPA = U.S. Environmental protection Agency
LOD = limit of detection
LOQ = limit of quantitation
mg/kg = milligram per kilogram
PCBs = polychlorinated biphenyls

SAP Worksheet #15.10 – Reference Limits and Evaluation Table

(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil (testing of imported fill material)
Analytical Group: Pesticides by EPA Method 8081B

Analyte	CAS Number	Project Screening Limit[3] (mg/kg)	Project Screening Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific		
					LOQ (mg/kg)	**LOD** (mg/kg)	**DL** (mg/kg)
4,4'-DDE	72-54-8	1.9	EPA Residential RSL[1]	0.9	0.00170	0.0005	0.00022
4,4'-DDD	72-55-9	2.0	EPA Residential RSL[1]	1.0	0.00170	0.0005	0.00026
4,4'-DDT	50-29-3	1.9	EPA Residential RSL[1]	0.9	0.00170	0.001	0.0004
Aldrin	309-00-2	0.039	EPA Residential RSL[1]	0.019	0.00170	0.0005	0.00021
alpha-BHC	319-84-6	0.086	EPA Residential RSL[1]	0.040	0.00170	0.0005	0.00022
beta-BHC	319-85-7	0.3	EPA Residential RSL[1]	0.015	0.00170	0.001	0.00033
Chlordane (technical)	12789-03-6	1.7	EPA Residential RSL[1]	0.85	0.0250	0.02	0.0085
Dieldrin	60-57-1	0.034	EPA Residential RSL[1]	0.017	0.00170	0.00027	0.000091
Endosulfan I	959-98-8	470	EPA Residential RSL[1] for Endosulfan	235	0.00170	0.00027	0.0001
Endosulfan II	33213-65-9	470	EPA Residential RSL[1] for Endosulfan	235	0.00170	0.00027	0.0001
Endrin	72-20-8	19	EPA Residential RSL[1]	9	0.00170	0.00027	0.00011
gamma-BHC	58-89-9	0.57	EPA Residential RSL[1]	0.28	0.00170	0.0005	0.00017
Heptachlor	76-44-8	0.13	EPA Residential RSL[1]	0.065	0.00170	0.0005	0.00019
Heptachlor epoxide	1024-57-3	0.070	EPA Residential RSL[1]	0.035	0.00170	0.00027	0.00012
Methoxychlor	72-43-5	320	EPA Residential RSL[1]	160	0.00340	0.003	0.0013
Toxaphene	8001-35-2	0.49	EPA Residential RSL[1]	0.24	0.067	0.05	0.02

Notes:

[1]Values are from the EPA Region 9 Regional Screening Level for Residential Soil as presented in Regional Screening Level (RSL) Summary Table (TR=1E-6, HQ=1) May 2018.

[2]The LOQ does not meet the PAL; however, the LOD and DL are sufficient to meet the PAL. Non-detects will be reported to the LOD.

[3]Results will be reported on a dry-weight basis for comparison to the project action limits.

DL= detection limit
EPA = U.S. Environmental Protection Agency
LOD = limit of detection
LOQ = limit of quantitation
mg/kg = milligram per kilogram
RSL = regional screening level

SAP Worksheet #15.11 – Reference Limits and Evaluation Table
(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil (testing of imported fill material)
Analytical Group: Total Petroleum Hydrocarbons (TPH) by EPA Method 8015B/8260_CALUFT

Analyte	CAS Number	Project Action Limit[3] (mg/kg)	Project Action Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific		
					LOQ (mg/kg)	**LOD** (mg/kg)	**DL** (mg/kg)
TPH as gasoline range organics (C6-C12)	-3544[1]	100	Water Board Tier 1 ESL[2]	1	0.500	0.200	0.05
TPH as diesel range organics (C12-C24)	-3527[1]	230	Water Board Tier 1 ESL[2]	25	2.0	1.0	0.5
TPH as oil range organics (C24-C36)	-3528[1]	5,100	Water Board Tier 1 ESL[2]	25	20.0	10.0	3.77

Notes:
[1] CAS number listed is from the Navy Electronic Data Deliverable (NEDD) valid value list since a CAS number is not available for this analyte.
[2]Water Board Tier 1 Environmental Screening Level (ESL) based on residential land use (Feb. 2016, Rev. 3)
[3]Results will be reported on a dry-weight basis for comparison to the project action limits.
DL = detection limit
LOD=limit of detection
LOQ=limit of quantitation
mg/kg = milligrams per kilogram

SAP Worksheet #15.12 – Reference Limits and Evaluation Table

(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil (testing of imported fill material)
Analytical Group: Metals by EPA Method 6020A/7471B

Analyte	CAS Number	Project Action Limit[3] (mg/kg)	Project Action Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific		
					LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
Antimony	7440-36-0	31	EPA Residential RSL[1]	15	0.500	0.400	0.200
Arsenic	7440-38-2	0.11	HERO HHRA Note 3[2]	1.0[5]	1.00	0.800	0.400
Barium	7440-39-3	15,000	EPA Residential RSL[1]	7,500	2.00	1.00	0.500
Beryllium	7440-41-7	1,600	HERO HHRA Note 3[2]	800	0.100	0.0800	0.0400
Cadmium	7440-43-9	2,100	HERO HHRA Note 3[2]	1,000	0.0500	0.0480	0.0240
Chromium	7440-47-3	120,000	EPA Residential RSL[1]	6,000	1.00	0.900	0.450
Cobalt	7440-48-4	23	EPA Residential RSL[1]	10	0.200	0.150	0.0750
Copper	7440-50-8	3,100	EPA Residential RSL[1]	1,500	1.00	0.800	0.400
Lead	7439-92-1	80	HERO HHRA Note 3[2]	40	0.300	0.250	0.125
Mercury	7439-97-6	1	HERO HHRA Note 3[2]	0.5	0.0330	0.0300	0.0110
Molybdenum	7439-98-7	390	EPA Residential RSL[1]	190	0.500	0.400	0.200
Nickel	7440-02-0	1,500	HERO HHRA Note 3[2]	750	0.500	0.400	0.200
Selenium	7782-49-2	390	EPA Residential RSL[1]	190	0.500	0.400	0.320
Silver	7440-22-4	390	HERO HHRA Note 3[2]	190	0.200	0.150	0.0750
Thallium	7440-28-0	0.78	EPA Residential RSL[1]	0.50	0.500	0.400	0.200
Vanadium	7440-62-2	390	HERO HHRA Note 3[2]	190	1.00	0.800	0.400
Zinc	7440-66-6	23,000	EPA Residential RSL[1]	11,000	5.00	4.00	2.00

Notes:
[1] Values are from the EPA Region 9 Regional Screening Level for Residential Soil as presented in Regional Screening Level (RSL) Summary Table (TR=1E-6, HQ=1) May 2018.
[2] Values are from the Human and Ecology Risk Office (HERO) Human Health Risk Assessment (HHRA) Note 3 (DTSC, 2018).
[3]Results will be reported on a dry-weight basis for comparison to the project action limits
[5]The LOQ does not meet the PAL; however, the method represents the best available technology. Non-detects will be reported to the LOD and uncertainty in any non-detects will be addressed in the QCSR.

DL = detection limit
EPA = U.S. Environmental Protection Agency

LOD = limit of detection
LOQ = limit of quantitation
mg/kg = milligrams per kilogram

SAP Worksheet #15.13 – Reference Limits and Evaluation Table

(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil (testing of imported fill material)
Analytical Group: Asbestos by CARB 435 or equivalent

Analyte	CAS Number	Project Screening Limit (%)	Project Screening Limit Reference	Project Quantitation Limit Goal (%)	Laboratory-specific	
					QL (%)	MDL
Asbestos	132207-33-1	0.25	Bay Area Air Quality Management District	0.25	0.25	1 fiber

Notes:

QL = quantitation limit
MDL = method detection limit

SAP Worksheet #15.14 – Reference Limits and Evaluation Table
(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil (testing of imported fill material)
Analytical Group: pH by EPA Method 9045D

Analyte	CAS Number	Project Screening Limit (pH Units)	Project Screening Limit Reference	Project Quantitation Limit Goal (pH Units)	Laboratory-specific		
					LOQ (pH Units)	LOD (pH Units)	DL (pH Units)
pH	-9[1]	6.5 < pH < 8.5	Water Board[2]	0.1	0.1	0.1	0.1

Notes:
[1] CAS number listed is from the Navy Electronic Data Deliverable (NEDD) valid value list since a CAS number is not available for this analyte.
[2]Remediation goal from the *San Francisco Bay (Region 2) Water Quality Control Plan (Basin Plan)* (Water Board, 2011).
Water Board = San Francisco Bay Water Quality Control Board

SAP Worksheet #15.15 – Reference Limits and Evaluation Table

(UFP-QAPP Manual Section 2.8.1)

Matrix: Water

Analytical Group: TPH by EPA 8015B

Analyte	CAS Number	Project Screening Limit (mg/L)	Project Screening Limit Reference	Project Quantitation Limit Goal (mg/L)	Laboratory-specific		
					LOQ (mg/L)	LOD (mg/L)	DL (mg/L)
TPH as gasoline range organics (C6-C12)	8006-61-9	NA[1]	Not Applicable	0.100	0.05	0.0300	0.015
TPH as diesel range organics (C12-C24)	-3527[1]	NA[1]	Not Applicable	0.500	0.05	0.04	0.0160
TPH as oil range organics (C24-C36)	-3546[21]	NA[1]	Not Applicable	0.500	0.500	0.400	0.166

Notes:

[1]TPH does not have a site-specific numeric goal for groundwater. Qualitatively, the goal for dissolved TPH will be mass reduction via target cleanup goals in soil (including any measurable free product) to support the numeric remedial goal for arsenic in groundwater.

[2]International Union of Pure and Applied Chemistry (IUPAC) CAS Number not available. Navy Electronic Data Deliverable (NEDD) compound code number used.

DL = detection limit

LOD = limit of detection

LOQ = limit of quantitation

SAP Worksheet #15.16 – Reference Limits and Evaluation Table
(UFP-QAPP Manual Section 2.8.1)

Matrix: Water
Analytical Group: Total and Dissolved Metals by EPA Method 6020A/7470A

Analyte	CAS Number	Project Screening Limit[1] (ug/L)	Project Screening Limit Reference	Project Quantitation Limit Goal (ug/L)	Laboratory-specific		
					LOQ (ug/L)	LOD (ug/L)	DL (ug/L)
Aluminum	7429-90-5	27	Ambient[4]	50[2]	50.0	40.0	20.0
Antimony	7440-36-0	1.7	Ambient[4]	5[3]	5.00	4.00	2.00
Arsenic	7440-38-2	36	RG[7]	15	10.0	8.00	4.00
Barium	7440-39-3	120	Ambient[4]	60	2.00	1.80	0.900
Beryllium	7440-41-7	0.04	Ambient[4]	0.5[3]	0.500	0.400	0.200
Cadmium	7440-43-9	8.8	NRWQC[5]	4	0.500	0.400	0.200
Calcium	7440-70-2	NE	Not Applicable	100	100	90.0	45.0
Chromium	7440-47-3	50	NRWQC[5]	25	10.0	8.00	4.00
Cobalt	7440-48-4	1.4	Ambient[4]	2[2]	2.00	1.80	0.900
Copper	7440-50-8	6.6	Ambient[4]	3	3.00	0.800	0.400
Iron	7439-89-6	200	Ambient[4]	100	50.0	40.0	20.0
Lead	7439-89-6	2 (5.6)	Ambient[4](Toxicity Screening Criteria)	3[2]	3.00	2.00	1.00
Magesium	7439-95-4	NE	Not Applicable	100	50.0	40.0	20.0
Manganese	7439-96-5	900	Ambient[4]	450	2.00	1.80	0.900
Mercury	7439-97-6	0.1	Ambient[4]	0.2[2]	0.200	0.150	0.0600
Molybdenum	7439-98-7	6.5	Ambient[4]	5	5.00	4.00	2.00
Nickel	7440-02-0	8.2	NRWQC[5]	5	5.00	4.00	2.00
Potassium	7440-09-7	NE	Not Applicable	100	100	90.0	45.0
Selenium	7782-49-2	71	NRWQC[5]	35	5.00	4.00	2.00
Silver	7440-22-4	2.2	Ambient[4]	2	2.00	1.80	0.900
Sodium	7440-23-5	NE	Not Applicable	100	100	90.0	45.0
Thallium	7440-28-0	426	NRWQC[5]	200	2.00	1.80	0.900
Vanadium	7440-62-2	4.2	Ambient[4]	2	10.0	8.00	4.00
Zinc	7440-66-6	81	NAWQC[6]	40	20.0	15.0	7.50

SAP Worksheet #15.16 – Reference Limits and Evaluation Table (Continued)

Notes:

[1]Project screening levels apply to dissolved metals results only. Total metals results are collected for informational purposes only, due to possible bias by non-mobile sediment particles in the sample.

[2]The LOQ does not meet the PSL; however, the LOD and/or DL are sufficient to meet the PSL. Non-detects will be reported to the LOD.

[3]The LOQ, LOD, and DL do not meet the PSL; however, the limits will be the lowest achievable using the best available technology by the laboratory's DoD ELAP-accredited methods. The laboratory will report to the lowest reporting limit (DL), but the value will be qualified as estimated ("J" flagged). Data evaluation will be based on reported concentrations above the DL. In cases where the PSL is less that the DL and the results are nondetect, results will be discussed in the uncertainty analysis.

[4]TTEMI 2001b. "Final Technical Memorandum, Estimation of Ambient Concentrations of Metals in Groundwater, Naval Station Treasure Island, San Francisco, California"

[5] NRWQC for Saltwater Aquatic Life, chronic exposure value

[6]NAWQC for protection of saltwater aquatic life, 20 percent of acute concentration with lowest observed effect level

[7]Goal from Tier 1 Screening-Level Ecological Risk Assessment for Treasure Island (IR Sites 6, 12, 21, 24, 30, 31, 32, and 33), Naval Station Treasure Island, San Francisco, California." Prepared by SulTech for U.S. Department of the Navy, BRAC PMO West. March 23.

DL – detection limit
LOD – limit of detection
LOQ – limit of quantitation
NAWQC – National Ambient Water Quality Criteria
NE – not established
NRWQC – National Recommended Water Quality Criteria
RG – Remedial Action Goal
PSL – project screening level
TTEMI – Tetra Tech EMI

SAP Worksheet #15.17 – Reference Limits and Evaluation Table
(UFP-QAPP Manual Section 2.8.1)

Matrix: Water
Analytical Group: Radium-226 by EPA Method 903.0

Analyte	CAS Number	Project Screening Limit (pCi/L)	Project Screening Limit Reference	Project Quantitation Limit Goal (pCi/L)	Laboratory-specific		
					MDC (pCi//L)	LOD (pCi/L)	DL (pCi/L)
Radium-226	13892-63-3	5	California MCL[1]	1	1.00	NA	NA

Notes:
[1] The combined Ra-226 and Ra-228 California MCL is used as the screening criteria for Ra-226.

DL = detection limit
LOD = limit of detection
MCL = maximum contaminant level
MDC = minimum detectable concentration

SAP Worksheet #15.18 – Reference Limits and Evaluation Table
(UFP-QAPP Manual Section 2.8.1)

Matrix: Water
Analytical Group: General Chemistry by EPA Method 300.0 and Standards Methods 2540C and 2540D

Analyte	CAS Number	Project Action Limit (ug/L)	Project Action Limit Reference	Project Quantitation Limit Goal (mg/L)	Laboratory-specific		
					LOQ (mg/L)	LOD (mg/L)	DL (mg/L)
Sulfate	14808-79-8	NE	Not Applicable	1	1.00	0.150	0.049
TDS	-10[1]	NE	Not Applicable	10	10	10.0	5.40
TSS	-44[1]	NE	Not Applicable	10	5.0	5.0	5.0

Notes:
[1] International Union of Pure and Applied Chemistry (IUPAC) CAS Number not available. Navy Electronic Data Deliverable (NEDD) compound code number used.
DL = detection limit
LOD = limit of detection
LOQ = limit of quantitation
NE = not established
TDS = total dissolved solids
TSS = total suspended solids

SAP Worksheet #16 – Project Schedule /Timeline Table
(UFP-QAPP Manual Section 2.8.2)

The project schedule is included as Figure 6 of this SAP.

SAP Worksheet #17 – Sampling Design and Rationale

(UFP-QAPP Manual Section 3.1.1)

The following sections describe the sampling designed to meet the project objectives.

17.1 Excavation of Contaminated Soils

Excavation will be conducted for the following four types of excavations:

- As per remedial alternative S-3 described in the ROD/Final RAP (Navy, 2017), non-SWDA discrete locations where COCs exceeded action levels in the soil during previous investigations (see Table 17-1). The discrete excavations will generally be 100 SF, and the total volume to be excavated is variable depending on the proposed depth of the excavation (Figure 2).
- The footprint of building 1126 after demolition. Chemical COCs, based on surrounding exceedances, are dioxin/furans, PAHs, lead, chromium (Figure 2).
- The footprint of building 1217 after demolition. Chemical COCs, based on surrounding exceedances, are PCBs, PAHs, and Pb (Figure 2).
- Continuation of the excavation of the North Point SWDA NTCRA. Chemical COCs are PCBs, dioxin/furans, PAHs, and Pb (Figure 3).

Table 17-1 COC Exceedances During Previous Investigations

Location ID	Sample Date	Sample Depth	COC	COC Value	COC Units	RG Value
1145E-1	8/27/2003	0.2	Total PCBs	1.43	mg/kg	1
1202E-1	9/2/2003	3.3	Total PCBs	3.83	mg/kg	1
1202E-1	9/2/2003	3.8	Total PCBs	8.05	mg/kg	1
1217E-1	9/2/2003	0.2	Benzo(a)pyrene TEQ	0.71	mg/kg	0.62
1225E-1	8/14/2003	0.4	Benzo(a)pyrene TEQ	0.98	mg/kg	0.62
1126C-1A	10/15/2003	2.7	Total PCBs	3.18	mg/kg	1
1126D-1	8/20/2003	0.4	Total PCBs	5.95	mg/kg	1
1126D-1	8/20/2003	2.7	Benzo(a)pyrene TEQ	12.82	mg/kg	0.62
1126D-3A	10/15/2003	0.7	Total PCBs	1.18	mg/kg	1
1128D-1	8/19/2003	0.4	Lead	1300	mg/kg	400
1128D-1	8/19/2003	1.2	Benzo(a)pyrene TEQ	2.98	mg/kg	0.62
1139A-1	8/27/2003	0.2	Benzo(a)pyrene TEQ	0.74	mg/kg	0.62
1147C-2	8/27/2003	0.7	Lead	670	mg/kg	400
1200DS004	2/23/2000	1	Benzo(a)pyrene TEQ	0.86	mg/kg	0.62
1200DS011	2/28/2000	4	Benzo(a)pyrene TEQ	1.06	mg/kg	0.62

SAP Worksheet #17 – Sampling Design and Rationale (Continued)

Table 17-1 COC Exceedances During Previous Investigations

Location ID	Sample Date	Sample Depth	COC	COC Value	COC Units	RG Value
1202F-1	9/3/2003	4	Chromium	332	mg/kg	280
1203A-1	8/28/2003	0.4	Lead	1300	mg/kg	400
1203A-1	8/28/2003	0.9	Lead	531	mg/kg	400
1203A-1	8/28/2003	0.9	Total Dioxin Furan TEQ	69.77	ng/kg	12
1203C-2A	10/15/2003	0.6	Total Dioxin Furan TEQ	14.9	ng/kg	12
1217B-1	9/2/2003	3.9	Chromium	452	mg/kg	280
1217D-1	9/3/2003	2.7	Lead	507	mg/kg	400
1217D-1	9/3/2003	2.7	Total Dioxin Furan TEQ	14.23	ng/kg	12
1219A-1	9/3/2003	3.5	Lead	418	mg/kg	400
1222-B1	5/17/2001	0.3	Total PCBs	1.6	mg/kg	1
1222F-5A	10/15/2003	1.4	Total Dioxin Furan TEQ	115.71	ng/kg	12
1225A-2	8/13/2003	2.6	Benzo(a)pyrene TEQ	3.27	mg/kg	0.62
1226G-1	8/28/2003	3.2	Lead	2600	mg/kg	400
1226H-1	8/28/2003	0.2	Benzo(a)pyrene TEQ	0.92	mg/kg	0.62
1227F-1-0	1/8/1995	0	Lead	864	mg/kg	400
1228A-1	9/3/2003	2.1	Total Dioxin Furan TEQ	120.81	ng/kg	12
1230A-1	9/3/2003	0.4	Benzo(a)pyrene TEQ	0.63	mg/kg	0.62
1230F-1	9/4/2003	0.3	Total Dioxin Furan TEQ	16.1	ng/kg	12
1232F-1	8/14/2003	0.2	Benzo(a)pyrene TEQ	0.86	mg/kg	0.62
1236-A1	3/29/2001	0.3	Lead	809	mg/kg	400
1239B-2	8/14/2003	0.4	Benzo(a)pyrene TEQ	0.77	mg/kg	0.62
12-HP100	10/26/1995	1.8	Chromium	431	mg/kg	280
12-HP116	9/23/1996	3.3	Benzo(a)pyrene TEQ	2.76	mg/kg	0.62
12-HP154	11/11/1997	3.5	Lead	632	mg/kg	400
12-HP174	11/13/1997	1.5	Chromium	315	mg/kg	280
12TP1248W17	11/2/2001	1	Benzo(a)pyrene TEQ	1.54	mg/kg	0.62
12TPMD010	11/3/1999	4.5	Pesticides (4,4'-DDD)	2.4	mg/kg	2
12TPMD010	11/3/1999	4.5	Pesticides (alpha-BHC)	0.1	mg/kg	0.077

SAP Worksheet #17 – Sampling Design and Rationale (Continued)

Table 17-1 COC Exceedances During Previous Investigations

Location ID	Sample Date	Sample Depth	COC	COC Value	COC Units	RG Value
12TPMD016	11/2/1999	4.8	Pesticides (4,4'-DDD)	2.2	mg/kg	2
12TPMD023	11/4/1999	5	Lead	523	mg/kg	400
KCH-1217-1	9/25/2014	2.5	Benzo(a)pyrene TEQ	10982	mg/kg	0.62
KCH-EU9-1	2/8/2013	4.5	Total PCBs	1.74	mg/kg	1
KCH-EU9-3	2/8/2013	3	Total PCBs	4.84	mg/kg	1
KCH-MDr-2	2/7/2013	1	Total Dioxin Furan TEQ	23.61	pg/g	12
KCH-MDr-3	2/7/2013	1	Total Dioxin Furan TEQ	17.2	pg/g	12
RA05-AOI-05	7/12/2017	5.0	Total PCBs	1,000	mg/kg	1
RA05-AOI-07	7/12/2017	5.0	Total PCBs	2.1	mg/kg	1
RA05-AOI-08	7/13/2017	8.0	Total PCBs	4.9	mg/kg	1
RA05-AOI-10	7/13/2017	8.0	Total PCBs	12	mg/kg	1
RA05-AOI-11	7/13/2017	8.0	Total PCBs	1.3	mg/kg	1
RA05-AOI-12	7/13/2017	8.0	Total PCBs	4.0	mg/kg	1
RA05-AOI-13	7/13/2017	5.0	Total PCBs	190	mg/kg	1
RA05-AOI-14	7/13/2017	5.0	Total PCBs	130	mg/kg	1
RA05-AOI-15	7/13/2017	5.0	Total PCBs	16	mg/kg	1
RA05-AOI-16	7/14/2017	5.0	Total PCBs	7.2	mg/kg	1
RA05-AOI-17	7/14/2017	5.0	Total PCBs	10	mg/kg	1
RA6B-AOI-07	7/11/2017	2.0	Total PCBs	10	mg/kg	1
RA7A-AOI-05	7/11/2017	2.0	Total PCBs	1.0	mg/kg	1
RA7D-AOI-07	7/11/2017	2.0	Total PCBs	6.4	mg/kg	1
RA7E-AOI-05	7/12/2017	1.7	Total PCBs	38	mg/kg	1
RA7E-AOI-06	7/12/2017	1.7	Total PCBs	17	mg/kg	1
RA7E-AOI-03	1/4/2017	1.7	Total PCBs	21 J	mg/kg	1

17.1.1 Chemical Confirmation Sampling

A combination of pre- and post-excavation confirmation sampling will be employed for this project. Pre-excavation samples will be collected in accordance with SOP PR-TC-02.02.01.03 (SAP Attachment

SAP Worksheet #17 – Sampling Design and Rationale (Continued)

A) and the RAWP to determine the extent of soil contamination prior to excavation. When an excavation is completed to the proposed limits, post-excavation confirmation soil samples will be collected from the excavation in accordance with SOP PR-TC-02.02.01.01 (SAP Attachment A) and the RAWP. The rationale for confirmation sampling is presented in Table 17-2 below.

Table 17-2 Pre- and Post-Excavation Confirmation Sampling

Action	Location Description	Sampling Relative to Excavation	Basis for Sampling		
			Vertical Extent[a]	Lateral Extent[b]	Suspect Location[c]
IR Site 12 Non-SWDAs	Discrete Hot Spots	Before	✓		
		After		✓	✓
	Building Footprints	Before	✓[d]	✓[e]	
		After			✓
North Point NTCRA	RG Exceedances	Before	✓	✓	
		After			✓

Notes:
[a] also referred to as bottom sample; collected at excavation bottom (i.e., minimum 1 ft below point of exceedance); sampling frequency: one sample per 2,500 square ft of excavation bottom (based on 50 ft x 50 ft grid square)
[b] also referred to as sidewall sample; collected at excavation sidewall at midpoint depth between surface and excavation bottom; sampling frequency: one sample per 50 linear ft of sidewall
[c] i.e., visually discolored soil, high gamma scan reading; collected at discretion of field supervisor
[d] collected across building footprint at vertical sampling frequency following building demolition
[e] collected around building perimeter at lateral sampling frequency prior to building demolition

Pre-excavation confirmation samples will be collected from Non-SWDA discrete hot spots to delineate the vertical extent of the excavation at 1-ft and 2-ft below the point of exceedance, with the 2-ft sample being held for analysis at the laboratory pending the results of the 1-ft sample. In addition, at those locations where the lateral extent of the excavation is obstructed by the presence of sidewalks, roads, utility corridors, etc., pre-excavation samples will be collected at the edge of the obstruction at midpoint depth between surface and 1-ft below the depth of the point of the exceedance. To delineate the vertical and lateral extent of the Non-SWDA demolished buildings and the North Point NTCRA, pre-excavation confirmation samples will be collected across the building footprints and in the planned excavation area, respectively, in each area larger than a 50-foot by 50-foot survey grid and around the perimeter every 50 linear feet.

All confirmation samples will be sent to an off-site DoD and California Environmental Laboratory Accreditation Program (ELAP)-certified laboratory for analysis. Confirmation samples will be analyzed for the following: (1) PAHs by EPA Method 8270SIM, (2) Dioxin/Furans by EPA 8290, (3) selected pesticides (alpha-BHC and 4,4’-DDD), (4) total Aroclors, (5) lead, and/or (6) chromium.

Pre- and post-confirmation samples will be evaluated against the following criteria at each excavation: (1) if the PSL (listed in Worksheet 15) for one or more analyte is greater than the LOQ, the reported result will be compared to the PSL. A reported result greater than or equal to the PSL will result in over-excavation; a reported result less than the PSL or non-detection at the LOD will require no further action; (2) if the

SAP Worksheet #17 – Sampling Design and Rationale (Continued)

PSL for the reported analyte is less than the LOQ, a detection of the analyte greater than the LOD will result in over-excavation; a non-detection of the analyte will result in no further action. Samples of either type requiring no further action will be used as final confirmation samples.

Samples requiring the analysis of lead or chromium in addition to organic analyses will have the metals analyzed on a short turn-around-time basis, with the organic analyses on hold until such time as the metals results have been shown to be less than the PSLs (WS # 15).

The following subsection discusses how over excavation will be performed.

17.1.2 Step-Out and/or Overexcavation Procedures

Step-outs and/or overexcavations will be performed if warranted based on analytical results. Excavations will be extended laterally (step-out) or vertically (overexcavation) if sidewall and/or floor post-excavation samples are found to contain contaminants exceeding the PSLs listed in Worksheet 15. Excavations may also be extended based on consultation with the Navy if there is visual confirmation of debris or if the soil is found to contain elevated radioactivity (in the form of elevated gamma activity).

For sidewall exceedances, an additional 2-foot lateral step-out will be excavated the length of the wall on either side of the sample location. For floor exceedances, an additional 2-foot vertical step-down will be excavated across a 2-foot by 2-foot floor area centered on the sample exceedance. The excavation step-out and step-down process will repeat until confirmation samples indicate COC concentrations are below the PSLs. The additional confirmation sample will be analyzed only for the analyte(s) exceeding remediation goals in the original confirmation sample.

17.1.3 Radiological Characterization

Radiological characterization will be completed in accordance with the RMDP (Appendix E of the Work Plan) once confirmation sampling confirms Dioxin/Furans, PAHs, selected pesticides, PCBs, lead, and/or chromium are below the PSLs based on MARSSIM guidance. The characterization samples will be located based on a random-start systematic grid in the sampling area with 20 samples per 1,000 square meters of excavation surface as further described in the RMDP. The samples will be analyzed for Radium-226 by EPA 901.1 Modified/DOE EML HASL 300 Method GA-01-R.

17.2 Benzo(a)pyrene and Dioxin Toxicity Equivalency Calculation

The BaPeq will be calculated by summing concentrations of carcinogenic PAH compounds after multiplying each concentration by their potency equivalence factors (PEFs). The PEFs used for this Project are from California Office of Environmental Health Hazard Assessment *Air Toxics Hot Spots Program Risk Assessment Guidelines* (2003). The PEFs for the carcinogenic PAHs are as follows:

- Benzo(a)pyrene 1.0
- Benzo(a)anthracene 0.1

SAP Worksheet #17 – Sampling Design and Rationale (Continued)

- Benzo(b)fluoranthene 0.1
- Benzo(k)fluoranthene 0.1
- Chrysene 0.01
- Dibenz(a,h)anthracene 1.0
- Indeno(1,2,3-cd)pyrene 0.1

Two BaPeq values are calculated: BaPeq(0) is calculated using only the detected values of all seven analytes and BaPeq(½) is calculated using one-half of LOD values for analytes that are not detected. The greater BAP (EQ) calculated value is used to compare with the remediation goal.

The dioxin toxicity equivalency factors (TEFs) will be calculated in accordance with Gilbane Work Instruction *Calculating Toxic Equivalence (TEQ) for Dioxins, Furans and Dioxin-Like Compounds.*The Dioxin-TEF will be calculated by summing concentrations of carcinogenic chlorinated dioxin and furan compounds after multiplying each concentration by their toxic equivalence factor. The TEFs used for this project are from California Office of Environmental Health Hazard Assessment *Air Toxics Hot Spots Program Risk Assessment Guidelines* (2015) using the 2005 World Health Organization TEFs. The WHO/05 TEFs for the dioxins and furans are listed in the aforementioned Gilbane Dioxin TEQ Work Instruction included in Attachment A.

17.3 Import Material Sampling

All excavations will be backfilled with imported soil that meets the project's acceptance criteria. Imported fill material testing will include collection of samples for analysis of the site-specific chemicals of concern, and other contaminants based on the nature of the fill source at the frequency presented in the *Information Advisory Clean Imported fill Material* (DTSC, 2001). The imported fill material acceptance criteria for IR Site 12 are presented in Worksheets #15-6 through #15-14.

17.4 Groundwater Monitoring at Gateview Arsenic/TPH Area

The goal as described on WS #11 for groundwater monitoring at Gateview Arsenic/TPH Area is to evaluate MNA parameters in groundwater against the criteria presented on WS # 15.15 through 15.18 with four quarters of sampling for TPH, total and dissolved metals, total dissolved solids (TDS), total suspended solids (TSS), sulfate, Ra-226, and ferrous iron in monitoring wells as listed on SAP Worksheet #18. The data is to supplement existing data collected as part of the basewide monitoring program. Trend analysis will be conducted on the dataset as a whole by the basewide monitoring contractor.

SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table
(UFP-QAPP Manual Section 3.1.1)

Sampling Location/ID Number[3]	Matrix	Depth (feet bgs)	Analytical Group	Estimated Number of Samples[2,6]	Sampling SOP Reference
Discrete Excavations					
At 1145E-1, **IR12-RA01-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1203C-2A, **IR12-RA02-ZZZ**	Soi1	TBD[1]	Dioxin/furans, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1147C-2, **IR12-RA03-ZZZ**	Soil	TBD[1]	Pb, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1203A-1, **IR12-RA04-ZZZ**	Soil	TBD[1]	Dioxin/furans, Pb, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1222F-5A, **IR12-RA05-ZZZ**	Soil	TBD[1]	Dioxin/furans, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1222-B1, **IR12-RA06-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1226G-1, **IR12-RA07-ZZZ**	Soil	TBD[1]	Pb, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1139A-1, **IR12-RA08-ZZZ**	Soil	TBD[1]	PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1128D-1, **IR12-RA09-ZZZ**	Soil	TBD[1]	PAH, Pb, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1226H-1, **IR12-RA10-ZZZ**	Soil	TBD[1]	PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1200DS004, **IR12-RA11-ZZZ**	Soil	TBD[1]	PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1225E-1, **IR12-RA12-ZZZ**	Soil	TBD[1]	PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1225A-2, **IR12-RA13-ZZZ**	Soil	TBD[1]	PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1200DS011, **IR12-RA14-ZZZ**	Soil	TBD[1]	PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 12-HP116, **IR12-RA15-ZZZ**	Soil	TBD[1]	PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1232F-1, **IR12-RA16-ZZZ**	Soil	TBD[1]	PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17

SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table (Continued)

Sampling Location/ID Number	Matrix	Depth (feet bgs)	Analytical Group	Estimated Number of Samples[2,6]	Sampling SOP Reference
Discrete Excavations					
At 1202E-1/KCH-EU9-1, **IR12-RA17-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At KCH-EU9-3, **IR12-RA18-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1126C-1A, **IR12-RA19-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1126D-3A, **IR12-RA20-001**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1126D-1, **IR12-RA21-ZZZ**	Soil	TBD[1]	PCB, PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 12TPMD023, **IR12-RA22-ZZZ**	Soil	TBD[1]	Pb, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1202F-1, **IR12-RA23-ZZZ**	Soil	TBD[1]	Cr, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1217B-1, **IR12-RA24-ZZZ**	Soil	TBD[1]	Cr, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1217E-1, **IR12-RA25-ZZZ**	Soil	TBD[1]	PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 12TPMD016, **IR12-RA26-ZZZ**	Soil	TBD[1]	Pesticides, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At KCH-1217-1, **IR12-RA27-ZZZ**	Soil	TBD[1]	PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 12-HP154, **IR12-RA28-ZZZ**	Soil	TBD[1]	Pb, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1217D-1, **IR12-RA29-ZZZ**	Soil	TBD[1]	Dioxin/furans, Pb, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1219A-1, **IR12-RA30-ZZZ**	Soil	TBD[1]	Pb, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1230F-1/KCH-MDr-2, **IR12-RA31-ZZZ**	Soil	TBD[1]	Dioxin/furans, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1228A-1, **IR12-RA32-ZZZ**	Soil	TBD[1]	Dioxin/furans, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17

SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table (Continued)

Sampling Location/ID Number	Matrix	Depth (feet bgs)	Analytical Group	Estimated Number of Samples[2,6]	Sampling SOP Reference
Discrete Excavations					
At KCH-MDr-3, **IR12-RA33-ZZZ**	Soil	TBD[1]	Dioxin/furans, Ra-226	4 sidewall, no bottom (Clean at 2' per FS for Dioxin/Furan)	SAP Worksheet #17
At 1230A-1, **IR12-RA34-ZZZ**	Soil	TBD[1]	PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 12-HP100, **IR12-RA35-ZZZ**	Soil	TBD[1]	Cr, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1227-F-1-0, **IR12-RA36-ZZZ**	Soil	TBD[1]	Pb, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 12-HP174, **IR12-RA37-ZZZ**	Soil	TBD[1]	Cr, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 12TP1248W17, **IR12-RA38-ZZZ**	Soil	TBD[1]	PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1236-A1, **IR12-RA39-ZZZ**	Soil	TBD[1]	Pb, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 1239B-2, **IR12-RA40-ZZZ**	Soil	TBD[1]	PAH, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At 12TPMD010, **IR12-RA41-ZZZ**	Soil	TBD[1]	Pesticides, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA05-AOI-05, **IR12-RA42-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA05-AOI-07, **IR12-RA43-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA05-AOI-08, **IR12-RA44-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA05-AOI-10, **IR12-RA45-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA05-AOI-11, **IR12-RA46-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA05-AOI-12, **IR12-RA47-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA05-AOI-13, **IR12-RA48-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA05-AOI-14, **IR12-RA49-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17

SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table (Continued)

Sampling Location/ID Number	Matrix	Depth (feet bgs)	Analytical Group	Estimated Number of Samples[2,6]	Sampling SOP Reference
Discrete Excavations					
At RA05-AOI-15, **IR12-RA50-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA05-AOI-16, **IR12-RA51-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA05-AOI-17, **IR12-RA52-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA06B-AOI-07, **IR12-RA53-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA07A-AOI-05, **IR12-RA54-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA07D-AOI-07, **IR12-RA55-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA07E-AOI-05, **IR12-RA56-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA07E-AOI-06, **IR12-RA57-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
At RA07E-AOI-03, **IR12-RA58-ZZZ**	Soil	TBD[1]	PCBs, Ra-226	4 sidewall, 1 bottom	SAP Worksheet #17
Building 1126					
IR12-1126-ZZZ	Soil	TBD[1]	Dioxin/furans, PAH, Pb, Cr, Ra-226	6 floor, 10 sidewall	SAP Worksheet #17
Building 1217					
IR12-1217-ZZZ	Soil	TBD[1]	PCB, PAH, Pb, Ra-226	4 floor, 9 sidewall	SAP Worksheet #17
SWDA/Northpoint					
IR12-SWDA-ZZZ	Soil	TBD[1]	Dioxin/furans, PCB, PAH, Pb, Ra-226	8 floor, 12 sidewall	SAP Worksheet #17

SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table (Continued)

Sampling Location/ID Number	Matrix	Depth (feet bgs)	Analytical Group	Estimated Number of Samples[2,6]	Sampling SOP Reference
Import Material					
IF-IR12-YYY-ZZZ	Soil	TBD[1]	VOCs, SVOCS, PCBs, Pesticides, Metals w/ Hg, TPH, Abestos, pH, Ra-226	TBD[4]	SAP Worksheet #17
Groundwater Monitoring at Gateview Arsenic/TPH Area[5]					
12-MW05-MMYY	Water	TBD	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate, Ra-226	4 (1 each quarter)	SAP Worksheet #17
12-MW07-MMYY	Water	TBD	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate, Ra-226	4 (1 each quarter)	SAP Worksheet #17
12-MW20R-MMYY	Water	TBD	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate, Ra-226	4 (1 each quarter)	SAP Worksheet #17
12-MW21R-MMYY	Water	TBD	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate, Ra-226	4 (1 each quarter)	SAP Worksheet #17
12-MW22R-MMYY	Water	TBD	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate, Ra-226	4 (1 each quarter)	SAP Worksheet #17
12-MW23-MMYY	Water	TBD	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate, Ra-226	4 (1 each quarter)	SAP Worksheet #17
12-MW24R-MMYY	Water	TBD	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate, Ra-226	4 (1 each quarter)	SAP Worksheet #17
12-MW33-MMYY	Water	TBD	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate, Ra-226	4 (1 each quarter)	SAP Worksheet #17
12-MW34-MMYY	Water	TBD	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate, Ra-226	4 (1 each quarter)	SAP Worksheet #17
12-MW35-MMYY	Water	TBD	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate, Ra-226	4 (1 each quarter)	SAP Worksheet #17
12-MW36-MMYY	Water	TBD	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate, Ra-226	4 (1 each quarter)	SAP Worksheet #17
12-MW37-MMYY	Water	TBD	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate, Ra-226	4 (1 each quarter)	SAP Worksheet #17
12-MW38R-MMYY	Water	TBD	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate, Ra-226	4 (1 each quarter)	SAP Worksheet #17

SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table (Continued)

Notes:
[1]TBD = To be determined. The depths of the excavations will be based on the information in Table 17-1. The exact depths of the excavations will be determined by field conditions and professional judgment of the project team.
[2] Estimated numbers of samples presented is for chemical samples. Numbers of radiological samples will be determined per Section 17.1.3 after the extent of the excavation is determined.
[3]ZZZ and YYY and MMYY in the sample name will be replaced as per Worksheet #27.
[4]Number of samples is dependent upon volume of imported fill material needed and will be determined as described in Section 17.3.
[5] Field duplicates will be collected at a rate of one per every 10 samples for groundwater samples. Field duplicate sample locations will be selected in the field. Sample ID of the field duplicate will end with "D."
[6]Each location will be collected as a discrete sample.

SAP Worksheet #19 – Analytical SOP Requirements Table

(UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group	Analytical and Preparation Method // SOP Reference	Containers (number, size, and type)	Sample volume[1] (units)	Preservation Requirements[2] (chemical, temperature, light protected)	Maximum Holding Time (preparation / analysis)
Soil	PAHs	EPA 8270D SIM/3550B//WS-MW-0008	1 X 4-oz Jar	30 g	<6°C	14 days/40 days
Soil	Dioxin/Furans	EPA 8290/ WS-IDP-0005 // WS-ID-0005	1 X 4-oz Jar	30 g	<6°C	30 days/45 days
Soil	Pesticide	EPA 8081B/3550B//WS-GC-0001	1 X 4-oz Jar	30 g	<6°C	14 days/40 days
Soil	PCBs	EPA 8082A/3550B//WS-GC-0002	1 X 4-oz Jar	30 g	<6°C	None
Soil	Metals	EPA 6010C/3050B//ST-MT-0003	1 X 2-oz Jar	2 g	None	180 days[3]
Soil	VOCs	EPA 8260C/5035//WS-MW-0007	3 X 5-g TerraCore™ Samplers[4,5,7] or equivalent	5 grams (g)	<6°C	48 hours/14 days
Soil	SVOCs	EPA 8270D/3550B// WS-MW-0008	1 X 4-oz Jar	30 g	<6°C	14 days/40 days
Soil	TPH-purgeable	EPA 8260C/5035//WS-MW-0007	3 X 5-g TerraCore™ Samplers[4,5,8] or equivalent	5 g	<6°C	14 days
Soil	TPH-extractable	EPA 8015B/3550B//WS-GC-0007	1 X 4-oz Jar	30 g	<6°C	14 days/40 days
Soil	Mercury	EPA 7471B//ST-MT-0007	1 X 2-oz Jar	2 g	<6°C	28 days[3]
Soil	Asbestos	CARB 435 or equivalent // EM-AS-S-1265	1 X 8-oz Jar or plastic baggie	8 ounce (oz.)	None	Not Applicable
Soil	pH	EPA 9045D//ST-WC-0011	1 X 2-oz Jar	10 g	<6°C	7 days

Matrix	Analytical Group	Analytical and Preparation Method // SOP Reference	Containers (number, size, and type)	Sample volume[1] (units)	Preservation Requirements[2] (chemical, temperature, light protected)	Maximum Holding Time (preparation / analysis)
Soil	Gamma Spectroscopy	EPA 901.1//ST-RD-0102	Gallon Ziploc bag then 250-milliliter (mL) tuna can	~1,000g (bag) ~300g (can)	None	None
Water	TPH-purgeable	EPA 8260C/5030B//WS-MW-0007	3x40-mL VOA Vial	40 mL	<6°C, (HCl to pH < 2 optional)	14 days
Water	Alpha Spectroscopy	EPA 903.0//ST-RC-0403	1-L Plastic	1-L	pH < 2, HNO_3	None
Water	TPH-extractable	EPA 8015B/3510C//WS-GC-0007	2 x 1-L mL Amber Glass	1 L	<6°C	7 days/40 days
Water	Metals (Total & Dissolved)	EPA 6020A/3010A//ST-MT-0001	250-mL Plastic	100 mL	pH <2, HNO_3	180 days
Water	Mercury (Total and Dissolved)	EPA 7470A//ST-MT-0005	250-mL Plastic	100 mL	<6°C, pH < 2, HNO_3	28 days
Water	Sulfate	EPA 300.0//WS-WC-0009	250-mL Plastic	50 mL	<6°C	28 days
Water	TDS	SM 2540C//WS-WC-0002	250-mL Plastic	100 mL	<6°C	7 days
Water	TSS	SM 2540D//WS-WC-0002	250-mL Plastic	100 mL	<6°C	7 days

Notes:

[1] Minimum sample volume or mass requirement if different from the container volume.

[2]Temperature compliance will be measured using temperature blanks included in the coolers used to ship the samples to the laboratory.

[3] The time listed is the maximum holding time for the analysis. Preparation time is included in the analytical method holding time.

[4] If TerraCore samplers cannot be used due to saturated soil, then only the 8-ounce jar (which will be filled without headspace) will be used, and VOC analysis will be conducted from the jar sample.

[5]TerraCore samples will be immediately transferred to suitable vials for transportation to laboratory per SOP PR-TC-02.02.01.05.

[6]Percent moisture will only be collected in a separate container when samples are to be analyzed for VOCs or TPH-purgeable only.

[7]Terracore kits for VOCs will consist of two unpreserved and one methanol-preserved vial because acid preservation may cause the chemical breakdown of certain reactive VOC compounds in the soil sample, specifically styrene, acrylonitrile, vinyl chloride, and 2-chloroethylvinyl ether (SOP PR-TC-02.02.01.05).

[8]Terracore kits for samples to be analyzed for TPH-purgeable only will consist of two bisulfate vials and one methanol vial.

SAP Worksheet #20 – Field Quality Control Sample Summary Table
(UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates	No. of MS/MSDs	No. of Field Blanks	No. of Equipment Blanks	No. of VOA Trip Blanks	No. of PT Samples	Total No. of Samples to Lab[4]
Soil (confirmation)	PAHs	124	None	7	None	None or 1 per/day[2]	None	None	124
Soil (confirmation)	Dioxin/Furans	70	None	4	None	None or 1 per/day[2]	None	None	70
Soil (confirmation)	PCBs	153	None	8	None	None or 1 per/day[2]	None	None	153
Soil (confirmation)	Pesticides	10	None	1	None	None or 1 per/day[2]	None	None	10
Soil (confirmation)	Metals (Cr)	20	None	1	None	None or 1 per/day[2]	None	None	20
Soil (confirmation)	Metals (Pb)	99	None	5	None	None or 1 per/day[2]	None	None	99
Soil (confirmation)	Radium-226	TBD[1]	None	None	None	None	None	None	TBD
Soil Imported Fill Material	Metals, VOCs, SVOCs, PAHs, PCBs, Pesticides, TPH, Ra-226	TBD[1]	None	2	None	None or 1 per/day[2]	None	None	TBD
Soil Imported Fill Material	Asbestos	TBD[1]	None	None	None	None	None	None	TBD
Water (GW Montitoring - 4 quarters)	TPH-purgeable	52[5]	8	4	None	None or 1 per/day[2]	12[3]	None	72
Water (GW Montitoring - 4 quarters)	TPH-extractable, Total and Dissolved Metals, General Chemistry	52[5]	8	4	None	None or 1 per/day[2]	None	None	60

SAP Worksheet #20 – Field Quality Control Sample Summary Table (Continued)

Notes:

[1]Actual sampling location (and thus the number of total samples to the laboratory) will be determined in the field based on the amount of excavated soil and the number of imported fill material sources sampled.
[2] None if disposable sampling equipment used; 1 per day if using non-disposable sampling equipment
[3]The actual number of trip blanks will depend on the number of coolers shipped containing samples for TPH-purgeable.
[4]The total number shipped to lab does not include MS/MSDs.
[5]The number of sampling locations is multiplied by four to account for the four planned sampling events.
PCB = polychlorinated biphenyl
PT = performance testing
TPH = total petroleum hydrocarbons
SVOC = semivolatile organic compound
VOA = volatile organic analysis
VOC = volatile organic compound

SAP Worksheet #21 – Project Sampling SOP References Table

(UFP-QAPP Manual Section 3.1.2)

Reference Number	Title, Revision Date and / or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
PR-TC-01.04.04.00	Field Documentation	Gilbane	Not Applicable	N	Attachment A of SAP
PR-TC-02.12.02.00	Sample Tracking and Electronic Data Management	Gilbane	Not Applicable	N	Attachment A of SAP
PR-TC-02.04.01.01	Sample Handling, Packaging and Shipping	Gilbane	Not Applicable	N	Attachment A of SAP
PR-TC-04.01.00.00	Review, Verification, and Validation of Chemical Data	Gilbane	Not Applicable	N	Attachment A of SAP
PR-TC-04.01.02.00	Review, Verification, and Validation of Radiological Data	Gilbane	Not Applicable	N	Attachment A of SAP
PR-TC-02.02.01.05	Volatile Organic Compound (VOC) Sampling	Gilbane	Per EPA 5035	N	Attachment A of SAP
PR-TC-02.02.01.01	Surface Soil: Sampling with Trowel or Spoon	Gilbane	Various	N	Attachment A of SAP
PR-TC-02.02.01.03	Subsurface Soils: Direct-Push or Drill Rig	Gilbane	Various	N	Attachment A of SAP
PR-TC-02.03.09.00	Water: Measuring Water Levels	Gilbane	Electronic Sounder	N	Attachment A of SAP
PR-TC-02.02.02.03	Water: Low-Flow Sampling from Ground Water Monitoring Wells	Gilbane	Various	N	Attachment A of SAP
Work Instruction	Calculating Toxic Equivalence (TEQ) for Dioxins, Furans and Dioxin-Like Compounds	Gilbane	Not Applicable	N	Attachment A of SAP

SAP Worksheet #22 – Field Equipment Calibration, Maintenance, Testing, and Inspection Table

(UFP-QAPP Manual Section 3.1.2.4)

Field Equipment	Activity	Frequency	Acceptance Criteria	Corrective Action	Resp. Person	SOP Reference	Comments
Photoionization Detector (PID)	• Calibration Check • Daily cleaning during field use • Proper storage when not in use	Daily (prior to field use)	Per manufacturer specifications	Recalibrate instrument, if still out, return instrument	Superintendent	(See Comments column)	Calibration procedure stated in the instrument manufacturer's operational instructions will be followed. Inoperable equipment will be removed from use and replaced.
Global Positioning System (GPS)	• No calibration Required • Charge batteries • Clean of dust, dirt, and grease • Store instrument in case when not in use	Daily (prior to field use)	± 10 mm horizontally and 15 mm vertically	If the instrument can not connect to satellites, then the secondary unit will be used to verify that there are no connections	Superintendent	(See Comments column)	Calibration procedure stated in the instrument manufacturer's operational instructions will be followed. Inoperable equipment will be removed from use and replaced.
Sodium Iodide Detector	Calibration Check	Daily (prior to field use)	Within 10% of the calculated activity isotope	Follow procedure as outlined in the manufacturer's instruction manaual or contact vendor for technical support.	Radiological Technician	(See Comments column)	Calibration procedure stated in the instrument manufacturer's operational instructions will be followed. Inoperable equipment will be removed from use and replaced.

SAP Worksheet #23 – Analytical SOP References Table

(UFP-QAPP Manual Section 3.2.1)

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
WS-GC-0007	Gas Chromatographic Analysis of Total Petroleum Hydrocarbons; (Revision 6.4)	Definitive	Soil & Water/TPH-extractable	GC/FID	TestAmerica	N
WS-MS-0007	Determination of Volatile Organics and Total Purgeable Petroleum Hydrocarbons by GC/MS (Methods 8260B, 8260C, 624, CA-LUFT and AK101); (Revision 5.6)	Definitive	Soil &Water/TPH-purgeable	Gas Chromatograph (GC)/Mass Spectrometer	TestAmerica	N
WS-GC-0002	Chromatographic Analysis Based on SW-846 Methods 8000B/8000C, 8082/8082A, Method 608, and Compendium Methods TO-4A and TO-10A; (Revision 5.3)	Definitive	Soil /PCBs	GC/Electron Capture Detector	TestAmerica	N
WS-GC-0001	Organochlorine Pesticides by Gas Chromatography Based on SW-846 Methods 8000B/8000C, 8081A/8081B, Method 608 and Compendium Methods TO-4A and TO-10A; (Revision 5.4)	Definitive	Soil/Pesticides	GC/Electron Capture Detector	TestAmerica	N
WS-MS-0008	Determination of Polycyclic Aromatic Hydrocarbons (PAH) by GC/MS-SIM Internal Standard Technique; (Revision 2.7)	Definitive	Soil/SVOCs & PAHs	GC/Mass Spectrometer (MS)	TestAmerica	N

Lab SOP Number	**Title, Revision Date, and / or Number**	**Definitive or Screening Data**	**Matrix and Analytical Group**	**Instrument**	**Organization Performing Analysis**	**Modified for Project Work?** (Y/N)
WS-MS-0007	Determination of Volatile Organics and Total Purgeable Petroleum Hydrocarbons by GC/MS (Methods 8260B, 8260C, 624, CA-LUFT and AK101); (Revision 5.6)	Definitive	Soil/VOCs	GC/MS	TestAmerica	N
ST-MT-0001	Analysis of Metals by Inductively Coupled Plasma/Mass Spectrometer[SW-846 6020; SW-846 6020A; SW-846 6020B; EPA 200.8] Revision 26	Definitive	Soil & Water/ICPMS Metals	ICP/Mass Spectrometer (MS)	TestAmerica	N
ST-MT-0003	Analysis of Metals by Inductively Coupled Plasma-Optical Emission Spectroscopy (ICP-OES) [SW-846 6010B; 6010C; 6010D; EPA 200.7] Revision 20	Definitive	Soil/ICP Metals	Inductively Coupled Plasma (ICP) Spectrophotometer	TestAmerica	N
ST-MT-0007	Preparation and Analysis of Mercury in Solid Samples by cold Vapor Atomic Absorption Spectroscopy [SW-846 7471B] Revision 17	Definitive	Soil/Mercury	Cold Vapor Atomic Absorption (CVAA)	TestAmerica	N
ST-MT-0005	Preparation and Analysis of Mercury in Aqueous Samples by Cold Vapor Atomic Absorption (SW846 7470A; MCAWW 245.1] Revision 18	Definitive	Water/Mercury	CVAA	TestAmerica	N

SAP Worksheet #23 – Analytical SOP References Table

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
WS-ID-0005	Analysis of Samples for Polychlorinated Dioxins and Furans by HRGC/HRMS [Methods 8290, 8290A & TO-9A] Revision 7.9	Definitive	Soil/Dioxins/Furans	High Resolution (HR) GC/HRMS	TestAmerica	N
WS-WC-0044	EPA Method 0945C and 9045D pH Solids and Manual pH Aqueous (Revision 6.6)	Definitive	Soil/pH	Probe	TestAmerica	N
EM-AS-S-1265	Asbestos Analysis in Soils and Rock: CARB 435 using PLM, Revision 2	Definitive	Asbestos	Polarized Light Microscopy	EM Laboratories P&K	N
ST-RD-0102	Gammavision^R Analysis [EPA 901.1 and DOE GA-01-R] Revision 16	Definitive	Soil/Gamma Spectroscopy	Gamma Spectrometer	TestAmerica	N
ST-RD-0403	Low Background Gas Flow Proportional Counting (GFPC) System Analysis [EPA 900.0, EPA 903.0, EPA 904.0, EPA 905.0; HASL 300 Ba-01-R, Sr-02, and Sr-03-RC] , Revision 19	Definitive	Water/Radium-226	Gas Flow Proportional Counter (GFPC)	TestAmerica	N
WS-WC-0009	Determination of Anions by Ion Chromatography (Method 300.0A & 9056); (Revision 3.5)	Definitive	Water/General Chemistry	Ion Chromatograph	TestAmerica	N
WS-WC-0002	Determination of All Types of Residue in Water, Wastes, and Soil Samples; (Revision 4.7)	Definitive	Water/General Chemistry	Balance/Drying Oven	TestAmerica	N

SAP Worksheet #24 – Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Gamma Spectrometer	Initial Calibration Verification (ICAL) for Energy, Efficiency, and FWHM peak resolution	Prior to initial use, following repair or loss of control and upon incorporation of new or changed instrument settings	The energy difference should be within 0.05% for all calibration points or wthin 0.2 keV. Peak energy difference is within 0.1 keV of refernce energy for all points. Peak Full width at Half Maximum (FWHM) < 3 keV at 1332 keV. The efficiency difference should be within 8% of the true value for each point unless T.C.C calibration is performed.	Correct problem, then repeat ICAL.	Lab Manager / Analyst[1]	ST-RD-0102
Gamma Spectrometer	Initial Calibration Verification (ICV)	After ICAL for energy/efficiency and prior to analysis of samples.	Observed peaks of second source standard fall within ± 10% of initial calibration value relative to the true value.	Verify second source standard and repeat ICV to check for errors. If that fails, identify and correct problem and repeat ICV or ICAL and ICV as appropriate.	Lab Manager / Analyst[1]	ST-RD-0102
Gamma Spectrometer	Continuing Calibration Verification (CCV) (Daily Check)	Daily or prior to use. When working with long count times or batch sequences that run more than a day, CCV is performed at the beginning and end of each analytical batch as long as it not longer than a week.	Energy: ±0.5 keV at 60 keV; ± .75 keV at 1332 keV. FW HM: ±1.2x at 60 keV; ±1.8x at 662 keV; ±2.3x at 1332 keV. Activity Difference: %difference between the source activity and the reported activity ±5%	Correct problem, rerun CCV. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	Lab Manager / Analyst[1]	ST-RD-0102

SAP Worksheet #24 – Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Gamma Spectrometer	Background Subtraction Count Measurement (BSC) (Long count for subtracting background from blanks or test sources)	Immediately after ICAL and then performed on at least a monthly basis.	Background count rate of the entire spectrum with ±3σ of the average.	Recount and check control chart for trends. Determine cause, correct problem, re-establish BSC. If background activity has changed, re-establish BSC and reanalyze or qualify all impacted samples since last acceptable BSC.	Lab Manager / Analyst[1]	ST-RD-0102
Gamma Spectrometer	Instrument Contamination Check (ICC) (Short count for controlling gross contamination)	Daily or when working with long count times before and after each analytical batch. Check after counting high activity samples.	No extraneous peaks identified (i.e., no new peaks in the short background spectrum compared to previous spectra); Background count rate of the entire spectrum with ±3σ of the average.	Recount the background. If still out of control, locate and correct problem; reanalyze or qualify all impacted samples since last acceptable ICC. If background activity has changed, re-establish BSC and reanalyze samples.	Lab Manager / Analyst[1]	ST-RD-0102
Gas Flow Proportional Counter	Initial Calibration - Voltage Plateau (ICALV) (separate plateaus determined for alpha and beta activity)	Prior to initial use and after loss of control.	Slope of the plateau less than 5% over a range of 100V.	Correct problem, then repeat ICALV.	Lab Manager / Analyst[1]	ST-RD-0403
Gas Flow Proportional Counter	Initial Calibration - Efficiency (ICALE)	Prior to initial use, after loss of control, and upon incorporation of new or changed instrument settings.	Verify manufacturer's specifications for detector efficiency for both alpha and beta counting modes using electroplated sources.	Correct problem, then repeat ICALE.	Lab Manager / Analyst[1]	ST-RD-0403

SAP Worksheet #24 – Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Gas Flow Proportional Counter	Initial Calibration – Cross-talk Factors (ICALCT)	Prior to initial use, after loss of control, and upon incorporation of new or changed instrument settings.	Verify manufacturer's specifications for cross talk in alpha and beta channels.	Correct problem, then repeat ICALCT.	Lab Manager / Analyst[1]	ST-RD-0403
Gas Flow Proportional Counter	Initial Calibration – Self-Absorption Curve (ICALSA)	Prior to initial use, after loss of control, and upon incorporation of new or changed instrument settings.	For each radionuclide of interest (or isotope with similar energy profile), establish mathematical function (curve) of detector efficiency vs. source mass loading. Best fit of data with coefficient of determination (r2) ≥ 0.9.	Correct problem, then repeat ICALSA.	Lab Manager / Analyst[1]	ST-RD-0403
Gas Flow Proportional Counter	Efficiency Calibration Verification (IECV)	After ICALE for alpha and beta and prior to analysis of samples.	Individual points within ±30% of true value, average of points within ±10% of initial calibration value.	Correct problem and verify second source standard. Rerun IECV. If that fails, correct problem and repeat ICALE.	Lab Manager / Analyst[1]	ST-RD-0403
Gas Flow Proportional Counter	Continuing Calibration Verification (CCV)	After a counting gas change and daily for short test-source counting intervals.	Within tolerance or control chart limits ± 3% or 3σ of the mean.	Correct problem, rerun calibration verification. If that fails, then repeat ICALE. Reanalyze all samples since the last successful calibration verification.	Lab Manager / Analyst[1]	ST-RD-0403
HCGC/HRMS	Tune / Mass Resolution Check (PFK)	At the beginning and the end of each 12-hour period of analysis.	Resolving power ≥ 10,000 at m/z=304.9842 & m/z=380.9760 + 5ppm of expected mass. Lock-mass ion between lowest and highest masses for each descriptor and level of reference ≤ 10% full-scale deflection.	Retune instrument & verify. Assess data for impact if end resolution is less than 10,000 narrate or reinject as necessary.	Lab Manager / Analyst[1]	WS-ID-0005

SAP Worksheet #24 – Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
HRGC/HRMS	GC Column Performance Check (CPSM/WDM per method)	Prior to ICAL or calibration verification.	Peak separation between 2,3,7,8-TCDD and other TCDD isomers result in a valley of ≤ 25%; and identification of all first and last eluters of the eight homologue retentention time windows and documentation by labeling (F/L) on the chromatogram; and absolute retention times for switching from one homologous series to the next ≥ 10 seconds for all components of the mixture.	1) Readjust windows. 2) Evaluate system. 3) Perform maintenance. 4) Reanalyze CPSM. 5) No corrective action is necessary if 2,3,7,8-TCDD is not detected and the % valley is greater than 25%.	Lab Manager / Analyst[1]	WS-ID-0005
GC/HRMS	Minimum five-point initial calibration for target analytes, lowest concentration standard at or near the reporting limit. (ICAL)	ICAL prior to sample analysis, as needed by the failure of calibration verification, and when a new lot is used as a standard source for calib verification, internal standard or recovery standard solutions.	RSD ≤ 20% for response factors for 17 unlabelled isomers & 9 labelled IS, and ion abundance ratios within limits specified in SOP; and S/N ≥ 10:1for target analytes.	Evaluate standard and instrument response. If problem with instrument (autosampler failure, response poor, etc) or standards, correct as appropriate, then repeat initial calibration.	Lab Manager / Analyst[1]	WS-ID-0005
GC/HRMS	Second-source calibration verification	Immediately following ICAL.	Ion abundance ratios in accordance with SOP; and RF (unlabelled standards) within ± 20%D of average RF from ICAL; and RF (labelled standards) within ± 30%D of average RF from ICAL.	Evaluate standards and instrument response. If standard issue, repeat or remake then repeat standard as appropriate. If still fails, repeat initial calibration	Lab Manager / Analyst[1]	WS-ID-0005

SAP Worksheet #24 – Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC/HRMS	Calibration Verification (CCV)	At the beginning of each 12-hour period, and at the end of each analytical sequence.	Ion abundance ratios in accordance with SOP; and RF (unlabelled standards) within ± 20%D of average RF from ICAL; and RF (labelled standards) within ± 30%D of average RF from ICAL.	Correct problem, repeat calibration verification. If fails, repeat ICAL and reanalyze all samples analyzed since last successful CCV End of Run CCV: If RF (unlabelled standards) > ± 20%D and ≤ ± 25%D and/or RF (labelled standards) > ± 30%D and ≤ ± 35%D of the average RF from ICAL use mean RF from bracketing CCVs to quantitate impacted samples. If bracketing CCVs differ by more than 25% RPD (unlabelled) or 35% RPD (labelled), run a new ICAL within 2 hours, and requantitate samples. Otherwise, reanalyze samples with positive detections.	Lab Manager / Analyst[1]	WS-ID-0005
GC/MS	Initial Calibration (ICAL) – five-point ICAL	Initial calibration prior to sample analysis	Percent relative standard deviation (%RSD)<20% all compounds, Relative Response Factor meet method criteria	Repeat calibration	Lab Manager / Analyst[1]	ST-MS-0002
GC/MS	Second Source Calibration Verification (CV)	Once after each initial calibration	Value of second source for all analytes within ±30% of expected	Rerun initial calibration verification (ICV) one time, second failure requires recalibration	Lab Manager / Analyst[1]	ST-MS-0002

SAP Worksheet #24 – Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC/MS	CV	Daily, before sample analysis, and every 12 hours of analysis time	+/- 20% difference (D) criteria for all analytes	Re-inject CV; if passes rerun previous ten samples and continue run; if 2nd CV fails, recalibrate	Lab Manager / Analyst[1]	ST-MS-0002
GC/MS	Tune Check	Prior to ICAL and prior to each 12-hour period of sample analysis	Specific ion abundance criteria of 4-bromofluorobenzene (BFB) from method	Retune instrument and verify	Lab Manager / Analyst[1]	ST-MS-0002
GC/MS	Retention Time window position establishment	Once per ICAL and at the beginning of the analytical sequence	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed.	N/A	Lab Manager / Analyst[1]	ST-MS-0002
GC/MS	Evaluation of Relative Retention Times (RRT)	With each sample	RRT of each reported analyte within +/- 0.06 RRT units	Correct problem, then rerun ICAL	Lab Manager / Analyst[1]	ST-MS-0002
GC/MS	ICAL – five-point ICAL	Initial calibration prior to sample analysis	%RSD<20% all compounds, Relative Response Factor meet method criteria	Repeat calibration	Lab Manager / Analyst[1]	ST-MS-0001
GC/MS	Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ±30% of expected	Rerun ICV one time, second failure requires recalibration	Lab Manager / Analyst[1]	ST-MS-0001
GC/MS	CV	Daily, before sample analysis, and every 12 hours of analysis time	+/- 20%D criteria for all analytes	Re-inject CV; if passes rerun previous ten samples and continue run; if 2nd CCV fails, recalibrate	Lab Manager / Analyst[1]	ST-MS-0001
GC/MS	Tune Check	Prior to ICAL and prior to each 12-hour period of sample analysis	Specific ion abundance criteria of DFTPP from method	Retune instrument and verify	Lab Manager / Analyst[1]	ST-MS-0001
GC/MS	Performance Check	At the beginning of each 12-hour period, prior to analysis of samples	Degradation ≤ 20% for DDT. Benzidine and pentachlorophenol shall be present at their normal responses, and shall not exceed a tailing factor of 2	Correct problem, then repeat performance checks	Lab Manager / Analyst[1]	ST-MS-0001

SAP Worksheet #24 – Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC/MS	Retention Time window position establishment	Once per ICAL and at the beginning of the analytical sequence	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	N/A	Lab Manager / Analyst[1]	ST-MS-0001
GC	Retention Time (RT) window width	At method set-up and after major maintenance (e.g. column change)	RT width is +/- 0.3 times standard deviation for each analyte RT from the 72-hour study	N/A	Lab Manager / Analyst[1]	ST-GC-0015, ST-GC-0016, ST-GC-0017
GC	Initial Calibration (ICAL) – five-point ICAL	Initial calibration prior to sample analysis	Mean RSD for each compound ≤ 20%	Recalibrate	Lab Manager / Analyst[1]	ST-GC-0015, ST-GC-0016, ST-GC-0017
GC	Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 30% of expected value (initial source)	Rerun ICV one time, second failure requires re-calibration	Lab Manager / Analyst[1]	ST-GC-0015, ST-GC-0016, ST-GC-0017
GC	Calibration Verification (Initial [ICV] and continuing [CCV])	ICV: Daily, before sample analysis CCV: After every 12 hours of analysis time and at the end of the analysis sequence	All analytes within ± 20% of expected value from the ICAL	Re-inject CCV; if passes rerun previous 10 samples and continue run; if 2nd CCV fails, recalibrate	Lab Manager / Analyst[1]	ST-GC-0015, ST-GC-0016, ST-GC-0017
GC	Confirmation of positive results (second column)	All positive results must be confirmed	Calibration and QC criteria are the same for the second column. RPD<40% between primary and second column results	Evaluate data, then report with flag to denote RPD > 40%. Narrate obvious matrix issues.	Lab Manager / Analyst[1]	ST-GC-0015, ST-GC-0016, ST-GC-0017
GC/FID	ICAL – five-point ICAL	Initial calibration prior to sample analysis	Linear mean RSD ≤ 20%	Recalibrate	Lab Manager / Analyst[1]	ST-GC-0005
GC/FID	Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 25% of expected value (initial source)	Rerun ICV one time, second failure requires recalibration	Lab Manager / Analyst[1]	ST-GC-0005

SAP Worksheet #24 – Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC/FID	Calibration Verification (ICV and continuing [CCV])	ICV: Daily, before sample analysis. CCV: Every 12 hours of analysis time and at the end of the analysis sequence	All analytes within ± 15% of expected value from the ICAL	Re-inject CCV; if passes rerun previous 10 samples and continue run; if 2nd CCV fails, recalibrate	Lab Manager / Analyst[1]	ST-GC-0005
GC/FID	Retention Time (RT) window position establishment	Once per ICAL and at the beginning of the analytical sequence	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used	N/A	Lab Manager / Analyst[1]	ST-GC-0005
GC/FID	RT window width	At method set-up and after major maintenance (e.g. column change)	RT width is +/- 0.3 times standard deviation for each analyte RT from the 72-hour study	N/A	Lab Manager / Analyst[1]	ST-GC-0005
GC/FID	ICAL – five-point ICAL	Initial calibration prior to sample analysis	Linear mean RSD ≤ 20%	Recalibrate	Lab Manager / Analyst[1]	ST-GC-0014
GC/FID	Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 25% of expected value (initial source)	Rerun ICV one time, second failure requires recalibration	Lab Manager / Analyst[1]	ST-GC-0014
GC/FID	Calibration Verification (ICV and continuing [CCV])	ICV: Daily, before sample analysis. CCV: Every 12 hours of analysis time and at the end of the analysis sequence	All analytes within ± 15% of expected value from the ICAL	Re-inject CCV; if passes rerun previous 10 samples and continue run; if 2nd CCV fails, recalibrate	Lab Manager / Analyst[1]	ST-GC-0014
GC/FID	Retention Time (RT) window position establishment	Once per ICAL and at the beginning of the analytical sequence	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used	N/A	Lab Manager / Analyst[1]	ST-GC-0014

SAP Worksheet #24 – Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC/FID	RT window width	At method set-up and after major maintenance (e.g. column change)	RT width is +/- 0.3 times standard deviation for each analyte RT from the 72-hour study	N/A	Lab Manager / Analyst[1]	ST-GC-0014
ICP/AES	Linear Dynamic Range (LDR) or high-level check standard	At initial set up and checked every 6 months high a high standard at the upper limit of the range	Within + 10% of true value	Dilute samples within the calibration range, or re-establish/verify the LDR	Lab Manager / Analyst[1]	ST-MT-0003
ICP/AES	Initial Calibration (ICAL) – minimum one high standard and a calibration blank	Daily initial calibration prior to sample analysis	3 standards and a blank. Correlation Coefficient of ≥ 0.998	Recalibrate	Lab Manager / Analyst[1]	ST-MT-0003
ICP/AES	Second Source Calibration Verification (ICV)	Once after each initial calibration, prior to sample analysis	Value of second source for all analyte(s) within ± 10% of expected	Recalibrate	Lab Manager / Analyst[1]	ST-MT-0003
ICP/AES	Continuing Calibration Verification (CCV)	After every 10 samples and at the end of the analysis sequence	All analytes within + 10% of expected value	Recalibrate – rerun 10 samples previous to failed CCV.	Lab Manager / Analyst[1]	ST-MT-0003
ICP/AES	Calibration Blanks (ICB/CCB)	After ICV (ICB) and after every CCV (CCB)	All analytes less than LOQ	Correct problem and rerun ICB or CCB and all bracketing samples	Lab Manager / Analyst[1]	ST-MT-0003
ICP/AES	Low-level Calibration Check Standard (Low-level ICV)	Daily	All analytes within + 30% of expected value	Correct problem and repeat ICAL	Lab Manager / Analyst[1]	ST-MT-0003

SAP Worksheet #24 – Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
ICP/AES	Interference Check Solutions (ICS)	After ICAL and prior to sample analysis	ICS-A: Absolute value of concentration for all non-spiked project analytes < LOD(unless they are a verified trace impurity from one of the spike analytes). ICS-AB: within + 20% of true value	Terminate analysis; locate and correct problem; reanalyze ICS, reanalyze all samples	Lab Manager / Analyst[1]	ST-MT-0003
ICP-MS	Linear Dynamic Range (LDR) or high-level check standard	At initial set up and checked every 6 months high a high standard at the upper limit of the range	Within + 10% of true value	Dilute samples within the calibration range, or re-establish/verify the LDR	Lab Manager / Analyst[1]	ST-MT-0001
ICP-MS	Tuning	Prior to ICAL	Mass calibration < 0.1 amu from the true value; Resolution < 0.9 amu full width at 10% peak height	Retune instrument and verify	Lab Manager / Analyst[1]	ST-MT-0001
ICP-MS	Initial Calibration (ICAL) – minimum one high standard and a calibration blank	Daily initial calibration prior to sample analysis	3 standards and a blank. Correlation Coefficient of ≥ 0.998	Recalibrate	Lab Manager / Analyst[1]	ST-MT-0001
ICP-MS	Second Source Calibration Verification (ICV)	Once after each initial calibration, prior to sample analysis	Value of second source for all analyte(s) within ± 10% of expected	Recalibrate	Lab Manager / Analyst[1]	ST-MT-0001
ICP-MS	Continuing Calibration Verification (CCV)	After every 10 samples and at the end of the analysis sequence	All analytes within + 10% of expected value	Recalibrate – rerun 10 samples previous to failed CCV.	Lab Manager / Analyst[1]	ST-MT-0001
ICP-MS	Calibration Blanks (ICB/CCB)	After ICV (ICB) and after every CCV (CCB)	All analytes less than LOQ	Correct problem and rerun ICB or CCB and all bracketing samples	Lab Manager / Analyst[1]	ST-MT-0001
ICP-MS	Low-level Calibration Check Standard (Low-level ICV)	Daily	All analytes within + 20% of expected value	Correct problem and repeat ICAL	Lab Manager / Analyst[1]	ST-MT-0001

SAP Worksheet #24 – Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
ICP-MS	Interference Check Solutions (ICS)	After ICAL and prior to sample analysis	ICS-A: Absolute value of concentration for all non-spiked project analytes < LOD(unless they are a verified trace impurity from on e of the spike analytes). ICS-AB: within + 20% of true value	Terminate analysis; locate and correct problem; reanalyze ICS, reanalyze all samples	Lab Manager / Analyst[1]	ST-MT-0001
Cold Vapor AA	Initial Calibration (ICAL)	Daily initial calibration prior to sample analysis	Correlation coefficient R>=0.995 for linear regression	Recalibrate	Lab Manager / Analyst[1]	ST-MT-0007 and ST-MT-0005
Cold Vapor AA	Second Source Calibration Verification (ICV)	Once after each initial calibration, prior to sample analysis	Value of second source for all analyte(s) within ± 10% of expected value (second source)	Recalibrate	Lab Manager / Analyst[1]	ST-MT-0007 and ST-MT-0005
Cold Vapor AA	Continuing Calibration Verification (CCV)	After every 10 samples and at the end of the analysis sequence.	All analytes within + 20% of expected value	Recalibrate – rerun 10 samples previous to failed CCV.	Lab Manager / Analyst[1]	ST-MT-0007 and ST-MT-0005
CVAA	ICB/CCB	After ICV (ICB) and after every CCV (CCB)	All analytes less than LOQ	Correct problem and rerun ICB or CCB and all bracketing samples	Lab Manager / Analyst[1]	ST-MT-0007 and ST-MT-0005
Electronic Probe	Initial Calibration	Prior to sample analysis	A three point calibration is performed. Buffer solutions of 4, 7, and 10 are used. Readings must be within ±0.05 for each buffer solution.	Recalibrate	Lab Manager / Analyst[1]	ST-WC-0011
Electronic Probe	Continuing Calibration	Check the calibration by analyzing the calibration check standard (pH 7 buffer) after the initial calibration, every ten samples, and at the end of the analytical run	pH reading must be within ±0.05 of the ph 7 buffer.	Recalibrate – rerun samples bracketed by failing CCV	Lab Manager / Analyst[1]	ST-WC-0011

SAP Worksheet #24 – Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Ion Chromatography (IC)	Initial Calibration (ICAL) – five-point calibration and a calibration blank	Weekly initial calibration prior to sample analysis	The intercept of the curve at zero must be < +/- the reporting limit. Correlation Coefficient of ≥ 0.995	Recalibrate	Lab Manager / Analyst[1]	ST-WC-0028
IC	Second Source Calibration Verification (ICV)	Once after each initial calibration, prior to sample analysis	Value of second source for all analyte(s) within ± 10% of expected	Recalibrate	Lab Manager / Analyst[1]	ST-WC-0028
IC	Continuing Calibration Verification (CCV)	After every 10 samples and at the end of the analysis sequence	All analytes within + 10% of expected value	Recalibrate – rerun 10 samples previous to failed CCV.	Lab Manager / Analyst[1]	ST-WC-0028

Notes:
[1] The analyst initiates the corrective action and the lab manager and analyst are responsible for the corrective action implementation.

SAP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

(UFP-QAPP Manual Section 3.2.3)

Instrument / Equipment	Activity (Maintenance / Testing / Inspection)	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Gamma Spectrometer	Clean cave; fill dewar with N2	Weekly	Acceptable background	Recalibrate	TestAmerica Analyst	ST-RD-0102
Gamma Spectrometer	QA Check of background and source (check deviation)	Daily	Within 3 sigma of measured population	Instrument maintenance and consult with Technical director	TestAmerica Analyst	ST-RD-0102
Gas Flow Proportional Counter (GFPC)	Clean Instrument	Daily	None applicable	Recalibrate	TestAmerica Analyst	ST-RD-0403
GFPC	Inspect windows	High counts and/or background	No physical defects	Instrument maintenance	TestAmerica Analyst	ST-RD-0403
GC-MS	Clean sources, maintain vacuum pumps	Service vacuum pumps twice per year, other maintenance as needed	Tune and CCV pass criteria	Recalibrate instrument	TestAmerica Chemist	WS-MW-0007, WS-MW-0008
GC-MS	Change septum, clean injection port, change or clip column, install new liner, change trap	As needed	Tune and CCV pass criteria	Re-inspect injector port, cut additional column, reanalyze CCV, recalibrate instrument	TestAmerica Chemist	WS-MW-0007, WS-MW-0008
GC	Change septum, clean injection port, change or clip column, install new liner, replace column, filters and seals	As needed	CCV passes criteria	Re-inspect injector port, cut additional column, reanalyze CCV, recalibrate instrument	TestAmerica Chemist	WS-GC-0001, WS-GC-0007
ICP/MS	Replace disposables, clean/change nebulizer, torch, and cones	As needed	Tune and CCV pass criteria	Recalibrate	TestAmerica Chemist	ST-MT-0001
ICP/AES	Clean/Replace sample lines/probe, FAST valve, torch, nebulizer, spray chamber	As needed	ICV and CCV pass criteria	Recalibrate	TestAmerica Chemist	ST-MT-0003
CVAA	Clean windows, optics, lamp. Inspect tubing and glassware	As needed	ICV and CCV pass criteria	Recalibrate	TestAmerica Chemist	ST-MT-0005

SAP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

(UFP-QAPP Manual Section 3.2.3)

Instrument / Equipment	Activity (Maintenance / Testing / Inspection)	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
GC/HRMS	Parameter Setup	Initially; prior to DCC	Correct Parameters	Reset if incorrect	TestAmerica Chemist	WS-ID-0005
GC/HRMS	Tune Check	Initially; prior to DCC	Compliance to ion abundance criteria	Correct the problem and repeat tune check	TestAmerica Chemist	WS-ID-0005
pH probe	Clean and inspect	Day of use	Meet method criteria	Clean probe; reanalyze any affected samples	TestAmerica Chemist	ST-WC-0011
Balance	Clean pan and weighing compartment	As needed	Balance meets criteria	Recalibrate	TestAmerica Chemist	WS-WC-0002
Ion Chromatograph	Change guard columns, Replace Tubing, Change Pump Seals	As needed	No interference/ carry over peaks; no leaks; stable retention times	Replace guard column, replace worn tubing, change pump seals	TestAmerica Analyst	WS-WC-0009

SAP Worksheet #26 – Sample Handling System
(UFP-QAPP Manual Appendix A)

SAMPLE HANDLING SYSTEM

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Sampler / Gilbane
Sample Packaging (Personnel/Organization): Sampler / Gilbane
Coordination of Shipment (Personnel/Organization): Sampler / Gilbane
Type of Shipment/Carrier: Overnight shipping service such as FedEx or Laboratory Courier
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Laboratory receipt clerk / TestAmerica
Sample Custody and Storage (Personnel/Organization): Laboratory technician or custodian / TestAmerica
Sample Preparation (Personnel/Organization): Laboratory technician / TestAmerica
Sample Determinative Analysis (Personnel/Organization): Analyst / TestAmerica
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): 90 calendar days
Sample Extract/Digestate Storage (Number of days from extraction/digestion): Up to 40 calendar days depending on method holding times
Biological Sample Storage (Number of days from sample collection): NA
SAMPLE DISPOSAL
Personnel/Organization: Sample Custodian / TestAmerica
Number of Days from Analysis: 90 calendar days

Notes:
NA = Not applicable

SAP Worksheet #27 – Sample Custody Requirements Table
(UFP-QAPP Manual Section 3.3.3)

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory):
Standardized sample custody procedures will be followed from sample collection, through transfer, storage, and analysis, to ultimate disposal in accordance with SOP PR-TC-02.04.01.01. Sample custody begins with shipment of the empty sample containers from the laboratory to the office or site. Sample containers will be shipped from the laboratory in sealed containers with appropriate seals and custody information. Sample containers will be properly labeled, and collected samples will be monitored for temperature control, as required, in the field and during laboratory transport and storage. Temperature blanks will be used in coolers containing samples requiring preservation at reduced temperature. Samples will be accompanied by a chain-of-custody record. When samples are transferred, both the individual relinquishing and the individual receiving the samples will sign, date, and note the transfer time on the COC record. Samples will be packaged for shipment with completed sample labels for each sample container, sample containers carefully packed upright and on ice (as required), and with a COC record in a Ziploc bag.

Custody seals will be used when samples are shipped via commercial courier service, and will be placed on the cooler so that the seals have to be broken before the cooler can be opened. The seals will be signed and dated by the field personnel. Samples may be hand-delivered to the laboratory, transported by commercial or laboratory couriers, or shipped to the laboratory using an overnight shipper.

Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal):
A designated laboratory sample custodian will accept custody of the samples and verify that the information on the sample labels matches that on the chain-of-custody form(s). Pertinent information as to sample condition, shipment, pickup, and courier will also be checked on the chain-of-custody form. The temperature inside the cooler and of the temperature blank will be measured immediately after the cooler is opened (as required), and the results will be recorded. Information on the date and time of receipt, method of shipment, and sample condition will also be recorded on a sample receipt form which will be forwarded to the Gilbane Project Chemist. The custodian will then enter the appropriate data into the laboratory sample tracking system. The sample custodian will use the sample numbers on the sample labels for tracking and also assign a unique laboratory number to each sample. The custodian will then transfer the samples to the proper analyst(s) or store the samples in the appropriate secure area. Data sheets and laboratory records will be retained by the laboratory as part of the permanent documentation for a period of at least three years. Samples and extracts will be retained by the analytical laboratory for a minimum of 90 days after the laboratory reports the data. Unless notified otherwise, samples may be disposed of by the laboratory in a manner consistent with local government regulations.

Chain-of-Custody Procedures:
A COC form will be completed for every group of samples sent to the analytical laboratory, to document sample possession from the time of collection to sample receipt by the laboratory; and a copy of the form will accompany the shipment. Each completed COC form will contain the

SAP Worksheet #27 – Sample Custody Requirements Table (Continued)

following information: sample identification number(s); name(s) and signature(s) of collectors, samplers, or recorders; Gilbane project number, project name, and location of project; the project manager's name and contact information; the date and time of collection; sample type(s) and analyses requested; and signatures of persons relinquishing and receiving the samples. When samples are transferred, the individuals relinquishing and receiving the samples will sign, date, and note the transfer time on the COC form.

In addition to providing a custody exchange record for the samples, the COC record serves as a formal request for sample analyses. The COC records will be completed, signed, and distributed as described in SOP PR-TC-02.12.02.00, *Sample Handling and Electronic Data Management*.

Sample Numbering

The sample number will be recorded in the field logbook, on the labels, and on the chain-of-custody record at the time of sample collection. A complete description of the sample and sampling conditions will be recorded in the field logbook and referenced using the unique sample identification number.

Samples will be uniquely designated using a numbering system that identifies the CTO number, location/type of sample, and a sequential number as follows:

- Soil samples collected from building excavations: **XXXX-YYYY-ZZZ**, where:
  XXXX– IR designation (e.g., IR12)
  YYYY – four-character designation for the building (e.g., 1217)
  ZZZ – three-character consecutive number (begins with 001) to designate the number of samples collected from the excavation

- Soil samples collected from SWDA/Northpoint excavation: **XXXX-YYYY-ZZZ**, where:
  XXXX– IR designation (e.g., IR12)
  YYYY – four-character designation for the excavation (e.g., SWDA)
  ZZZ – three-character consecutive number (begins with 001) to designate the number of samples collected from the excavation

- Soil samples collected from 58 discrete point excavations: **XXXX-RAYY-ZZZ**:
  XXXX– IR designation (e.g., IR12)
  RA – indicates "Remedial Action"
  YY – two-character consecutive number (begins with 01) to designate the number of the excavation
  ZZZ – three-character consecutive number (begins with 001) to designate the number of samples collected from the excavation

- Soil samples collected from imported fill material sources: **IF-XXXX-YYY-ZZZ**, where:
  IF – represents Import Fill
  XXXX – IR designation (e.g., IR12)
  YYY- three-character consecutive number (begins with 001) to designate the number of the source
  ZZZ – three-character consecutive number (begins with 001) to designate the number of samples collected from a source

SAP Worksheet #27 – Sample Custody Requirements Table (Continued)

- RSY Survey Pads: **XXXX-RSY-QQQQ-UU**, where:
  XXXX – IR designation (e.g., IR12)
  QQQQ – Four-character consecutive pad number 0001; continues consecutively throughout the CTO with no repeated numbers
  UU – Two-character consecutive sample number starting with 01 (number of samples collected from each reference area)

- Groundwater Monitoring Samples: **XX-YYYYY-MMDD**, where:
  XX – Two character IR designation (e.g., 12)
  YYYYY – Up to five character well designation (e.g. MW17)
  MM – Two-character designation for the month in which the sample was collected
  YY – Two-character designation for the year in which the sample was collected

Sample Packaging – Chemical Samples

Chemical samples will be packaged and shipped in accordance with SOP PR-TC-02.04.01.01, *Sample Handling, Packaging, and Shipping.*

Sample Packaging - Radiological Samples

Samples will be delivered for analysis to the laboratory via cooler, box, or other similar container (ice is not required if only radiological analyses will be performed), along with the completed COC. Samples to be sent off site will be packaged in accordance with applicable Department of Transportation (DOT) and International Air Transport Association (IATA) procedures. At a minimum, sample containers will be placed in a box, cooler, or similar container for shipment and packaged with bubble wrap or other materials as necessary to prevent container breakage.

For samples transported via commercial carrier, two custody seals will taped across the lid of the box or cooler: one seal in the front and one seal on the side. The COC will include the airbill number, and the “Received By” box will be labeled with the commercial courier’s name. The COC will be sealed in a resealable bag and then taped to the inside of the sample cooler lid or placed inside the box. A copy of the COC will be maintained on site and a copy will be e-mailed to the Project Chemist. The box/cooler will be taped shut as necessary. The airbill will be completed for priority overnight delivery and placed in the pouch, which then will be secured to the box/cooler. If multiple boxes/coolers are being shipped, the original COC will be placed in one of the boxes/cooler, and copies of the COC will be placed in the other boxes/coolers. The number of packages should be included on each airbill (e.g., 1 of 2, 2 of 2). Prepared packages will be surveyed prior to shipment..

SAP Worksheet #28 – Laboratory QC Samples Table
(UFP-QAPP Manual Section 3.4)

Matrix	Soil
Analytical Group	Gamma Spectroscopy
Analytical Method / SOP Reference[1]	EPA 901.1M/ST-RD-0102

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank (MB)	One per preparation batch	No analytes detected > target detection limit	Correct problem. If required, re-prepare and reanalyze MB and all samples processed with the contaminated blank.	Analyst, Supervisor	Accuracy/Bias/ Contamination	Acceptable results per stated QC Acceptance Limits
Laboratory Control Sample (LCS)	One per preparation batch	Recovery limits: 87-120% for Cs-137, 87-115% for Co-60, 87-116% for Am-241	Correct problem, then re-prepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.	Analyst, Supervisor	Accuracy/Bias	Acceptable QC Acceptance Limits
Sample Duplicate	One per preparation batch	RPD limit of 40% or Relative Error Ration <1	Correct problem, then re-prepare and reanalyze all samples in the associated preparatory batch, if not excursion not cuased by sample matrix.	Analyst, Supervisor	Precision/ Accuracy/Bias	Acceptable QC Acceptance Limits

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	Dioxin/Furans
Analytical Method / SOP Reference[1]	EPA 8290/ WS-ID-0005

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MB	One per preparation batch	Project specific criteria, if available. Otherwise, no target analytes detected ≥ 1/2 LOQ or ≥ 10% of the associated regulatory limit or ≥ 10% of the sample result for the analyte, whichever is greater. (OCDD is considered a common laboratory contaminant and treated accordingly).	Verify instrument clean (evaluate calibration blank & samples prior to method blank), then reanalyze. Evaluate to determine if systematic issue within laboratory, correct, then re-prepare and reanalyze the method blank and all samples processed with the contaminated blank in accordance with DoD QSM requirements. “Totals” are not considered “target analytes” – no corrective action or flagging is necessary for "totals".	Chemist	Accuracy/Bias Contamination	No target analytes ≥ 1/2 LOQ
LCS	Every field sample, standard and QC sample	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Reanalyze LCS once. If acceptable, report. Otherwise, if exceedence is not a critical chemical of concern as identified by the project team, evaluate for sporadic marginal exceedence (SME). If acceptable, report with case narrative comment. If not acceptable for SME, evaluate samples for detections, and LCS for high bias. If LCS has high bias, and samples non-detect, report with case narrative comment. If LCS has low bias, or if there are detections for critical chemicals of concern, evaluate and reprep and reanalyze the LCS and all samples in the associated prep batch for failed analytes, if sufficient sample material is available.	Lab Manager / Analyst	Accuracy/Bias Contamination	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	Dioxin/Furans
Analytical Method / SOP Reference[1]	EPA 8290/ WS-ID-0005

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MS/MSD	One per 20 field samples	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Evaluate data, if samples non-detect and surrogate recovery is above upper limits, report with case narrative comment. If obvious chromatographic interference is present, report with narrative comment. Otherwise, reextract and reanalyze.	Laboratory technician	Precision	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.
Internal Standard (IS)	Every field sample, standard and QC sample	% recovery for each IS in the original sample (prior to dilutions) must be within 40-135%	Evaluate data, if samples non-detect and surrogate recovery is above upper limits, report with case narrative comment. If obvious chromatographic interference is present, report with narrative comment. Otherwise, reextract and reanalyze.	Lab Manager / Analyst	Precisions and Accuracy/Bias	Meets all EPA Method requirements (40-135% Recovery)

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	SVOCs
Analytical Method / SOP Reference[1]	EPA 8270D/WS-MS-0005

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
IS	During acquisition of calibration standard, samples, and QC check samples	Retention time within ± 10 seconds from retention time of the midpoint standard in the ICAL; EICP area within - 50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning in accordance with QSM requirements. If field samples still outside criteria, qualify data and explain in case narrative.	Lab Manager/ Analyst	Accuracy	Acceptable recoveries per stated QC Acceptance Limits
MB	One per preparation batch	No target analytes ≥ ½ RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). For common laboratory contaminants as noted below, no analytes detected >RL in accordance with QSM requirements Common lab contaminants are: bis-2-ethylhexylphthalate, di-n-octyl phthalate, butyl benzyl phthalate, di-n-butyl phthalate	Verify instrument clean (evaluate calibration blank & samples prior to method blank), then reanalyze. Evaluate to determine if systematic issue within laboratory, correct, then re-prepare and reanalyze the method blank and all samples processed with the contaminated blank in accordance with QSM requirements.	Lab Manager/ Analyst	Representativeness	Acceptable results per stated QC Acceptance Limits
MS/MSD	1 per twenty field samples	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Identify problem; if not related to matrix interference, re-reanalyze MS/MSD and all associated batch samples	Lab Manager/ Analyst	Precision/Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	SVOCs
Analytical Method / SOP Reference[1]	EPA 8270D/WS-MS-0005

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
LCS/LCSD	One LCS or LCS/LCSD pair per preparation batch per matrix	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Reanalyze LCS once. If acceptable, report. Otherwise, if exceedence is not a critical chemical of concern (CCoC) as identified by the project team, evaluate for sporadic marginal exceedence (SME). If acceptable, report with case narrative comment. If not acceptable for SME, evaluate samples for detections, and LCS for high bias. If LCS has high bias, and samples non-detect, report with case narrative comment. If LCS has low bias, or if there are detections for CCoC, evaluate and reprep and reanalyze the LCS and all samples in the associated prep batch for failed analytes, if sufficient sample material is available.	Lab Manager/ Analyst	Precision/ Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.
Surrogate	Every field sample and QC sample	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Evaluate data, if samples non-detect and surrogate recovery is above upper limits, report with case narrative comment. If obvous chromatographic interference is present, notify client prior to reporting data with narrative comment. Otherwise, reextract and reanalyze.	Lab Manager/ Analyst	Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	PAHs
Analytical Method / SOP Reference[1]	EPA 8270D/WS-MS-0008

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
IS	During acquisition of calibration standard, samples, and QC check samples	Retention time within ± 10 seconds from retention time of the midpoint standard in the ICAL; EICP area within - 50% to +100% of ICAL midpoint standard. On days with the ICAL is not analyzed, use the initial CCV.	Inspect mass spectrometer and GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning in accordance with QSM requirements. If field samples still outside criteria, qualify data and explain in case narrative.	Lab Manager/ Analyst	Accuracy	Acceptable recoveries per stated QC Acceptance Limits
MB	One per preparation batch	No target analytes detected greater than one-half LOQ and 1/10 the amount measured in any sample or 1/10 regulatory limit (whichever is greater). No laboratory common contaminants detected greater than LOQ.	Verify instrument clean (evaluate calibration blank & samples prior to method blank), then reanalyze. Evaluate to determine if systematic issue within laboratory, correct, then re-prepare and reanalyze the method blank and all samples processed with the contaminated blank in accordance with QSM requirements.	Lab Manager/ Analyst	Representative-ness	Acceptable results per stated QC Acceptance Limits
MS/MSD	1 per twenty field samples	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Identify problem; if not related to matrix interference, re-reanalyze MS/MSD and all associated batch samples.	Lab Manager/ Analyst	Precision/Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	PAHs
Analytical Method / SOP Reference[1]	EPA 8270DSIM/WS-MS-0008

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
LCS/LCSD	One LCS or LCS/LCSD pair per preparation batch per matrix	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Reanalyze LCS once. If acceptable, report. Otherwise, if exceedence is not a CCoC as identified by the project team, evaluate for sporadic marginal exceedence (SME). If acceptable, report with case narrative comment. If not acceptable for SME, evaluate samples for detections, and LCS for high bias. If LCS has high bias, and samples non-detect, report with case narrative comment. If LCS has low bias, or if there are detections for CCoC, evaluate and reprep and reanalyze the LCS and all samples in the associated prep batch for failed analytes, if sufficient sample material is available.	Lab Manager/ Analyst	Precision/Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.
Surrogate	Every field sample and QC sample	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Evaluate data, if samples non-detect and surrogate recovery is above upper limits, report with case narrative comment. If obvous chromatographic interference is present, notify client & report with narrative comment if approved. Otherwise, reextract and reanalyze if sufficient sample material is available.	Lab Manager/ Analyst	Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	PCBs
Analytical Method / SOP Reference[1]	EPA 8082A/ WS-GC-0002

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MB	One per preparation batch	No target analytes detected greater than one-half RL and 1/10 the amount measured in any sample or 1/10 regulatory limit (whichever is greater). No laboratory common contaminants detected greater than RL.	Verify instrument clean (evaluate calibration blank & samples prior to method blank), then reanalyze. Evaluate to determine if systematic issue within laboratory, correct, then re-prepare and reanalyze the method blank and all samples processed with the contaminated blank in accordance with QSM requirements	Lab Manager/ Analyst	Representativeness	Acceptable results per stated QC Acceptance Limits
MS/MSD	1 per twenty field samples	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Identify problem; if not related to matrix interference, re-reanalyze MS/MSD and all associated batch samples	Lab Manager/ Analyst	Precision/ Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.
LCS/LCSD	One LCS or LCS/LCSD pair per preparation batch per matrix	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Reanalyze LCS once. If acceptable, report. Otherwise, evaluate samples for detections, and LCS for high bias. If LCS has high bias, and samples non-detect, report with case narrative comment. If LCS has low bias, evaluate and reprep and reanalyze the LCS and all samples in the associated prep batch for failed analytes, if sufficient sample material is available.	Laboratory technician	Precision/ Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.

Matrix	Soil
Analytical Group	PCBs
Analytical Method / SOP Reference[1]	EPA 8082A/ WS-GC-0002

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Surrogate	Every standard and sample	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Evaluate data, if samples non-detect and surrogate recovery is above upper limits, report with case narrative comment. If obvous chromatographic interference is present, notify client & report with narrative comment if approved. Otherwise, reextract and reanalyze, if sufficient sample material available.	Laboratory technician	Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	Pesticides
Analytical Method / SOP Reference[1]	EPA 8081B/ WS-GC-0001

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
IS	One per preparation batch	RT within ± 0.06RRT units of RT of ICAL mid-point standard, Area within - 50% to +100% of ICAL midpoint standard. On days without ICAL, initial CCV may be used as reference.	Inspect GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning in accordance with QSM requirements. If field samples still outside criteria, qualify data and explain in case narrative.	Lab Manager/ Analyst	Accuracy	Acceptable recoveries per stated QC Acceptance Limits
MB	One per preparation batch	No target analytes detected greater than one-half RL and 1/10 the amount measured in any sample or 1/10 regulatory limit (whichever is greater). No laboratory common contaminants detected greater than RL.	Verify instrument clean (evaluate calibration blank & samples prior to method blank), then reanalyze. Evaluate to determine if systematic issue within laboratory, correct, then re-prepare and reanalyze the method blank and all samples processed with the contaminated blank in accordance with QSM requirements	Lab Manager/ Analyst	Representativeness	Acceptable results per stated QC Acceptance Limits
MS/MSD	1 per twenty field samples	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Identify problem; if not related to matrix interference, re-reanalyze MS/MSD and all associated batch samples	Lab Manager/ Analyst	Precision/Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.

Matrix	Soil					
LCS and/or LCSD	One LCS or LCS/LCSD pair per preparation batch per matrix	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Reanalyze LCS once. If acceptable, report. Otherwise, if exceedence is not a CCoC as identified by the project team, evaluate for sporadic marginal exceedence (SME). If acceptable, report with case narrative comment. If not acceptable for SME, evaluate samples for detections, and LCS for high bias. If LCS has high bias, and samples non-detect, report with case narrative comment. If LCS has low bias, or if there are detections for CCoC, evaluate and reprep and reanalyze the LCS and all samples in the associated prep batch for failed analytes, if sufficient sample material is available.	Lab Manager/ Analyst	Precision/Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.
Surrogate	Every field sample and QC sample	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Evaluate data, if samples non-detect and surrogate recovery is above upper limits, report with case narrative comment. If obvous chromatographic interference is present, notify client & report with narrative comment if approved. Otherwise, reextract and reanalyze, if sufficient sample material available.	Lab Manager/ Analyst	Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.

SAP Worksheet #28 – Laboratory QC Samples Table
(UFP-QAPP Manual Section 3.4)

Matrix	Soil
Analytical Group	pH
Analytical Method / SOP Reference[1]	EPA 9045D / WS-WC-0044

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per preparation batch	Results within buffer ranges	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Lab Manager/ Analyst	Representativeness	Results within buffer ranges
LCS	One LCS per preparation batch per matrix	Percent Recoveries: 99-101% (lab-derived limits)	Correct problem, then re-reanalyze the LCS and all associated batch samples	Lab Manager/ Analyst	Accuracy	Percent Recoveries: 99-101% (lab-derived limits)
Duplicate	One per prep batch	RPD Limit: 5% (lab-derived limits)	Correct problem, then re-reanalyze the DUP and all associated batch samples	Analyst	Precision	RPD Limit: 5% (lab-derived limits)
pH Buffer Ranges	Before beginning a sample run, at 4.0, 7.0, and 10.0 standard unit	Percent Recoveries: 99-101% (lab-derived limits)	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Analyst	Accuracy	Percent Recoveries: 99-101% (lab-derived limits)

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

(UFP-QAPP Manual Section 3.4)

Matrix	Soil and Water
Analytical Group	TPH-extractable
Analytical Method / SOP Reference[1]	EPA 8015B/WS-GC-0007

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MB	One per preparation batch	No target analytes detected greater than one-half RL and 1/10 the amount measured in any sample or 1/10 regulatory limit (whichever is greater). No laboratory common contaminants detected greater than RL.	Verify instrument clean (evaluate calibration blank & samples prior to method blank), then reanalyze. Evaluate to determine if systematic issue within laboratory, correct, then re-prepare and reanalyze the method blank and all samples processed with the contaminated blank in accordance with QSM requirements	Lab Manager/ Analyst	Representativeness	Acceptable results per stated QC Acceptance Limits
MS/MSD	1 per twenty field samples	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Identify problem; if not related to matrix interference, re-reanalyze MS/MSD and all associated batch samples	Lab Manager/ Analyst	Precision/Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.

Matrix	Soil and Water
Analytical Group	TPH-extractable
Analytical Method / SOP Reference[1]	EPA 8015B/WS-GC-0007

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
LCS /LCSD	One LCS or LCS/LCSD pair per preparation batch per matrix	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Reanalyze LCS once. If acceptable, report. Otherwise, if exceedence is not a critical chemical of concern (CCoC) as identified by the project team, evaluate samples for detections, and LCS for high bias. If LCS has high bias, and samples non-detect, report with case narrative comment. If LCS has low bias, or if there are detections for CCoC, evaluate and reprep and reanalyze the LCS and all samples in the associated prep batch for failed analytes, if sufficient sample material is available.	Lab Manager/ Analyst	Precision/Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.
Surrogate	Every field sample and QC sample	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Evaluate data, if samples non-detect and surrogate recovery is above upper limits, report with case narrative comment. If obvous chromatographic interference is present, notify client & report with narrative comment if approved. Otherwise, reextract and reanalyze, if sufficient sample material available.	Lab Manager/ Analyst	Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil and Water
Analytical Group	Metals
Analytical Method / SOP Reference[1]	EPA 6010C/6020A/7471B// ST-MT-0003/ST-MT-0001/ST-MT-0007

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MB	One per preparation batch	No target analytes detected greater than one-half RL and 1/10 the amount measured in any sample or 1/10 regulatory limit (whichever is greater). No laboratory common contaminants detected greater than RL.	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Lab Manager/ Analyst	Representativeness	Acceptable results per stated QC Acceptance Limits
MS/MSD	1 per twenty field samples	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Identify problem; if not related to matrix interference, re-reanalyze MS/MSD and all associated batch samples	Lab Manager/ Analyst	Precision/Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.
LCS and/or LCSD	1 per preparatory batch (defined as ≤ 20 samples)	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.	Correct problem, then re-prep and re-reanalyze the LCS and all associated batch samples for failed analytes, if sufficient sample volume is available and samples are within 2x the hold time. Qualify data accordingly if reprep & re-analysis cannot be performed or if reprep & reanalysis also has failed analytes	Lab Manager/ Analyst	Accuracy	Per DoD QSM/ laboratory limits as listed in Attachment B to this SAP.

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Soil and Water
Analytical Group	Metals
Analytical Method / SOP Reference[1]	EPA 6010C/6020A/7471B// ST-MT-0003/ST-MT-0001/ST-MT-0007

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Serial Dilution	Each new sample matrix	1:5 dilution must agree within ±10% of original determination.	Perform post-digestion spike if serial dilution does not meet criteria	TestAmerica - St. Louis Analyst	Accuracy	1:5 dilution must agree within ±10% of original determination.
Post-digestion Spike	When serial dilution or matrix spike fails	Recovery within 80-120%	Re-analyze post-digestion spike.	TestAmerica - St. Louis Analyst	Accuracy	Recovery within 80-120%

SAP Worksheet #28 -- Laboratory QC Samples Table
(UFP-QAPP Manual Section 3.4)

Matrix	Water					
Analytical Group	Radium-226					
Analytical Method / SOP Reference[1]	EPA 903.0 / ST-RD-0403					
QC Sample	**Frequency / Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Method Blank (MB)	One per preparation batch	No analytes detected > target detection limit	Correct problem. If required, re-prepare and reanalyze MB and all samples processed with the contaminated blank.	Analyst, Supervisor	Accuracy/Bias/ Contamination	Acceptable results per stated QC Acceptance Limits
Laboratory Control Spike	One per preparation batch	Recovery limits: 68-137% for Ra-226	Correct problem, then re-prepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.	Analyst, Supervisor	Accuracy/Bias	Acceptable QC Acceptance Limits
Laboratory Duplicates	One per preparation batch	RPD limit of 40% or Relative Error Ratio <1	Correct problem, then re-prepare and reanalyze all samples in the associated preparatory batch, if not excursion not cuased by sample matrix.	Analyst, Supervisor	Precision/ Accuracy/Bias	Acceptable QC Acceptance Limits
Barium Carrier	Every Sample	Recovery limits of 40-110%	Truncate carriers above 100% recovery to eliminate low biased results. Reprep and reanalyze sample if carrier is low (indicating high biased results) if there is activity in the sample above the reporting limit. No reanalysis if matrix interference is noticed during sample preparation.	Analyst, Supervisor	Accuracy/Bias	Acceptable QC Acceptance Limits

SAP Worksheet #28 -- Laboratory QC Samples Table
(UFP-QAPP Manual Section 3.4)

Matrix	Water
Analytical Group	General Chemistry - Anions
Analytical Method / SOP Reference[1]	EPA 300.0/ WS-WC-0009

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per preparation batch	No target analytes detected greater than one-half RL and 1/10 the amount measured in any sample or 1/10 regulatory limit (whichever is greater). No laboratory common contaminants detected greater than RL.	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Lab Manager/ Analyst	Representativeness	Acceptable results
LCS	One LCS per preparation batch per matrix	QSM limits (if available), otherwise recovery 90-110% for aqueous samples samples.	Reanalyze LCS once. If acceptable, report. Evaluate samples for detections, and LCS for high bias. If LCS has high bias, and samples non-detect, report with case narrative comment. If LCS has low bias, evaluate and reprep and reanalyze the LCS and all samples in the associated prep batch for failed analytes, if sufficient sample material is available.	Lab Manager/ Analyst	Accuracy	Acceptable Percent Recoveries and RPD

Matrix	Water					
MS/MSD	One MS per preparation batch per matrix	90-110% control limits for each analyte. RPD ≤ 15% between MS and MSD.	Identify problem; if not related to matrix interference, re-reanalyze MS/MSD and all associated batch samples	Lab Manager/ Analyst	Precision/Accuracy	Acceptable Percent Recovery

SAP Worksheet #28 – Laboratory QC Samples Table (continued)

Matrix	Water
Analytical Group	General Chemistry - Solids
Analytical Method / SOP Reference[1]	SM 2540 C & D/ WS-WC-0002

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per preparation batch	No target analytes detected greater than one-half RL and 1/10 the amount measured in any sample or 1/10 regulatory limit (whichever is greater). No laboratory common contaminants detected greater than RL.	Evaluate date. If all associated samples > 10 x level in the blank, narrate, and report. Otherwise, correct problem, then re-prepare and reanalyze the method blank and all samples less than 10 x the level in the blank.	Lab Manager/ Analyst	Representativeness	Acceptable results
LCS/LCSD	One LCS or LCSD per preparation batch per matrix	Percent Recoveries: 80% to 120% (lab-derived statistical limits)	Terminate analysis, identify and correct the problem, then re-prepare and reanalyze all affected samples and QC checks	Lab Manager/ Analyst	Accuracy	Percent Recoveries: 80% to 120% (lab-derived statistical limits)
Duplicate	One DUP per preparation batch per matrix	20% RPD between sample and dupicate.	Correct problem, then re-reanalyze the DUP and all associated batch samples	TestAmerica - St. Louis Analyst	Precision	RPD Limit: 20% (lab-derived statistical limits)

SAP Worksheet #29 – Project Documents and Records Table

(UFP-QAPP Manual Section 3.5.1)

Document	Where Maintained
RAWP, which includes this SAP	Project file, NAVFAC SW Administrative Record
Field forms	Project file
Chain-of-custody forms	Project file, laboratories; NAVFAC SW will receive a copy of definitive data chain-of-custody records
Shipping Records	Project file
Audit/assessment checklists/reports	Project file and laboratory (if applicable)
Corrective action forms/reports	Project file and laboratory (if applicable)
Field change request forms	Project file
Analytical laboratory data packages (Level III- or Level IV-equivalent)	Laboratory and project file; NAVFAC SW Administrative Record
Data validation reports	Validator and project file; NAVFAC SW Administrative Record

Field documentation associated with sampling activities includes field forms, sample labels, chain-of-custody records, sample shipping records, field surveillance reports, and Field Change Request (FCR) forms. In addition, laboratory and data validator documentation will be generated during this project. These types are described in the following sections.

Field Logbooks/Forms

Field forms (or logbooks) will be handled in accordance with SOP PR-TC-01.04.04.00, *Field Documentation* (included in Attachment A of this SAP).

Sample Labels

For radiological analysis of fill material, a resealable plastic bag will be used to collect soil samples. Sample labels will be generated at the time the chain-of-custody record is prepared, and affixed to the resealable plastic bag and the prepared sample container (if one is used during sample processing). The label will contain the following:

- Sample identification number.
- Sample collection date (month/day/year)
- Analytical method.
- Time of collection.
- Sampler’s initials.

SAP Worksheet #29 – Project Documents and Records Table (Continued)

If containers are too small to fit all the sample information listed above, at a minimum the container will be labeled with the sample identification number, and the remaining information will be recorded on the chain of custody.

For chemical samples to be sent to the laboratory labels will be hand-written using indelible black or blue ink on a waterproof label and affixed to each sample container at the time of sample collection (or labels may be computer generated). The label will contain the following information:

- Sample identification number.
- Sample collection date (month/day/year).
- Time of collection (24-hour clock).
- Sampler's initials.
- Preservative (if any).

Chain of Custody

Chain-of-custody record information is described in SAP Worksheet #27.

Sample Shipping Records

For samples couriered to the laboratory, the chain of custody will be signed by the courier and a copy maintained on site in the project file. For samples shipped via FedEx, the chain-of-custody record will be packaged within the cooler, and the sender's copy of the airbill will serve as custody documentation and will be maintained on site in the project file. Sample shipping procedures are detailed in SAP Worksheet #27.

Field Surveillance Reports

Field surveillances will be performed in accordance with the three phases of inspection as required by the QC program. A Preparatory Inspection will be performed by the PQCM prior to the first sampling activities. This will include a general orientation for health and safety. An Initial Inspection will be conducted at the beginning of field sampling activities for this project. Daily field inspections and subsequent surveillances will be performed at the discretion of the PQCM or the QCPM throughout the duration of the project. The PQCM will use the Initial Inspection Checklist during inspection.

Field Change Request

An FCR will be prepared by the Program Chemist, or a designee, if a change to the SAP is needed during sampling activities. Any changes will be minor, and will not result in a change in scope or DQOs for this project. The FCR must be approved by the QCPM prior to field implementation.

SAP Worksheet #29 – Project Documents and Records Table (Continued)

Major changes to work scope affecting the DQOs or meeting criteria described in EWI #2, 3EVR.2, *Review, Approval, Revision, and Amendment of Sampling and Analysis Plans* (NAVFAC SW, 2006) will require preparation of a SAP Addendum. The SAP Addendum must be approved by the Navy QAO and the planning team identified on SAP Worksheet #10 prior to conducting sampling and analysis.

Laboratory Documentation

Relevant laboratory raw data and documentation, including but not limited to logbooks, data sheets, electronic files, and reports, will be maintained by the laboratory for at least 5 years. Gilbane must be notified 30 days before disposal of any relevant records. Laboratory data packages will be compliant the reporting requirements as described in Appendix A of the DoD QSM 5.1.1.

- Excavation confirmation soil samples and imported fill material used for backfill – 90 percent suitable for Stage 2B and 10 percent suitable for Stage 4.
- Groundwater Monitoring Samples – 90 percent suitable for Stage 2B and 10 percent suitable for Stage 4.
- Waste Characterization samples – 100 percent suitable for Stage 2A.

For Stage 2A-, 2B-, or 4-suitable data packages, an EDD will be uploaded directly to Gilbane's web-based portal at http://edms.gilbaneco.com. The hard-copy data package also will be uploaded in PDF format to the portal. Both the EDDs and the hard-copy data package will present results to two or three significant figures. For radiological results, at least three significant figures will be used. For organic results, at least two significant figures will be used. For inorganic results, at least two significant figures will be used for results less than 10, and at least three significant figures will be used for results greater than 10. Results for QC analyses (method blanks, MS/MSDs, LCSs, and duplicates) will be reported up to 3 significant figures.

When revisions to Stage 2A-, 2B-, or 4-suitable data packages are required, the report will be resubmitted in its entirety to both the portal and the Project Chemist, with the notation "amended or revised report." If the revisions affect the EDDs, the revised EDD also will be uploaded to the portal.

Data Validation Reports

Samples are to be validated in accordance with SAP Worksheet #36 and Gilbane SOP PR-TC-04.01.00.00 or PR-TC-04.01.02.00, as appropriate.

The validation report for definitive samples will include the data validation findings worksheets. Each laboratory sample delivery group (SDG) will have its own data validation report. The validation reports will contain the following information:

- Title page that contains project name, sample collection date, validator subcontractor name, report date, type of analysis, laboratory, sample delivery group (SDG), sample identifications (including MS/MSD, duplicate, reanalysis, or dilution samples), sample matrix (e.g., soil, water), and validation level (EPA Level III or IV).

SAP Worksheet #29 – Project Documents and Records Table (Continued)

- Introduction page including the number of samples per matrix, analytical method reference, validation guideline reference, section references to summary qualification flags, and identification of QC samples. The report body will include the acceptance criteria used to evaluate each QC parameter exceeding criteria, a list of all QC exceedances as well as the associated bias, the samples associated with each exceedance, and the qualifiers applied. Statements regarding flag classification (protocol/advisory) and whether a raw data check was performed also will be included.
- Evaluation and discussion of the following parameters:
  - Technical holding times.
  - GC/MS instrument performance check (tune) if applicable.
  - Calibration.
  - Laboratory blanks.
  - Accuracy and precision data for internal laboratory QC associated with each SDG.
  - Target compound identification.
  - System performance checks.
  - Analyte quantitation and quantitation limits (MDC and LOQs).
  - Field QC samples (if not applicable, report will note).
  - Overall assessment of data.
  - Qualifier classification.

The data validator will upload a PDF copy of the validation report to the project portal at http://edms.gilbaneco.com, and enter qualifiers directly to the database using the project portal.

The data validation subcontractor must maintain validation records for at least 5 years. Gilbane will be notified 30 days before disposal of any records.

SAP Worksheet #30 – Analytical Services Table
(UFP-QAPP Manual Section 3.5.2.3)

Matrix	Analytical Group	Sample Locations/ ID Number	Analytical Method	Data Package Turnaround Time	Laboratory / Organization (name and address, contact person and telephone number)	Backup Laboratory / Organization (name and address, contact person and telephone number)
Soil	Metals,	Samples as listed on SAP WS #18	Methods per SAP WS #19	10 Business Days	TestAmerica St. Louis 13715 Rider Trail North Earth City, MO 63045 Rhonda Ridenhower 314-787-8227 Rhonda.ridenhower@testamericainc.com	GEL Laboratories 2040 Savage Road Charleston, SC 29407 Jake Crook 843-769-7390 jhc@gel.com
Soil	PAHs, PCBs, Pesticides, VOCs, SVOCs, TPH, pH Dioxin/Furans	Samples as listed on SAP WS #18	Methods per SAP WS #19	20 Business Days	Subcontracted through St. Louis to: TestAmerica West Sac. 880 Riverside Parkway West Sacramento, CA 9560	GEL Laboratories 2040 Savage Road Charleston, SC 29407 Jake Crook 843-769-7390 jhc@gel.com
Soil	Ra-226	Samples as listed on SAP WS #18	E901.1M	20 Business Days	TestAmerica St. Louis 13715 Rider Trail North Earth City, MO 63045 Rhonda Ridenhower 314-787-8227 Rhonda.ridenhower@testamericainc.com	GEL Laboratories 2040 Savage Road Charleston, SC 29407 Jake Crook 843-769-7390 jhc@gel.com
Soil	Asbestos	Samples as listed on SAP WS #18	California Air Resources Board (CARB) 435	10 Business Days	Subcontracted through St. Louis to: EMPK Laboratories	GEL Laboratories 2040 Savage Road Charleston, SC 29407 Jake Crook 843-769-7390 jhc@gel.com

SAP Worksheet #30 – Analytical Services Table (Continued)

Matrix	Analytical Group	Sample Locations/ ID Number	Analytical Method	Data Package Turnaround Time	Laboratory / Organization (name and address, contact person and telephone number)	Backup Laboratory / Organization (name and address, contact person and telephone number)
Water	TPH, Total and Dissolved Metals, TDS, TSS, Sulfate	Samples as listed on SAP WS #18	Methods per WS #19	10 Business Days	TestAmerica St. Louis 13715 Rider Trail North Earth City, MO 63045 Rhonda Ridenhower 314-787-8227 Rhonda.ridenhower@testamercainc.com	GEL Laboratories 2040 Savage Road Charleston, SC 29407 Jake Crook 843-769-7390 jhc@gel.com
Water	Ra-226	Samples as listed on SAP WS #18	E903.0	30 Calendar Days	TestAmerica St. Louis 13715 Rider Trail North Earth City, MO 63045 Rhonda Ridenhower 314-787-8227 Rhonda.ridenhower@testamericainc.com	GEL Laboratories 2040 Savage Road Charleston, SC 29407 Jake Crook 843-769-7390 jhc@gel.com

Selected laboratories will have successfully completed the DoD ELAP certification for the matrices and methods listed in SAP Worksheet #23 and will maintain current status throughout the duration of this project. Laboratories also will be certified by the California Water Board under the ELAP for all of the analytical methods listed in SAP Worksheet #23. Laboratories will be capable of providing the project QC and data deliverables required by this SAP and the DoD QSM for Environmental Laboratories version 5.0. Asbestos testing is a specialty testing and will not require DoD or California ELAP, but will have the National Voluntary Laboratory Accreditation Program certification to perform asbestos analysis. Status of laboratory certifications/accreditations will be verified prior to fieldwork and before samples are delivered to lab. Updates to lab accreditation to ensure the laboratory is qualified to perform the analysis will be made prior to sample testing.

SAP Worksheet #31 – Planned Project Assessments Table
(UFP-QAPP Manual Section 4.1.1)

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (title and organizational affiliation)	Person(s) Responsible for Responding to Assessment Findings (title and organizational affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (title and organizational affiliation)
Field Sampling Surveillance	Annually; at least one technical systems audit (TSA) at the start of field activities, with discretionary follow-ups	Internal	Gilbane	PQCM (Gilbane)	Project Manager (Gilbane)	Project Manager (Gilbane)	Project Manager and PQCM (Gilbane)
Management Review	Once during the project	Internal	Gilbane	QCPM (Gilbane)	Project Manager (Gilbane)	Project Manager (Gilbane)	PQCM (Gilbane)

SAP Worksheet #32 – Assessment Findings and Corrective Action Responses
(UFP-QAPP Manual Section 4.1.2)

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Time-frame of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response	Time-frame for Response
Field Sampling Surveillance	Surveillance Report	Project Manager, Gilbane	7 days after completion of report	Corrective Action Report	Project Manager and QCPM, Gilbane	5 days after notification
Management Review	Surveillance Report	Project Manager, Gilbane	7 days after completion of report	Corrective Action Report	Project Manager, Gilbane	14 days after notification

SAP Worksheet #33 – QA Management Reports Table
(UFP QAPP Manual Section 4.2)

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (title and organizational affiliation)	Report Recipient(s) (title and organizational affiliation)
Field Sampling Surveillance Report	Once, at startup of sampling	Determined during the project	PQCM, Gilbane	Project Manager and QCPM, Gilbane
Management Review Report	Once, after management review is completed	Determined during the project	QCPM, Gilbane	Project Manager and Program Manager, Gilbane

SAP Worksheet #34 – Verification (Step I) Process Table
(UFP-QAPP Manual Section 5.2.1)

Verification Input	Description	Internal / External	Responsible for Verification (name, organization)
Field notes/logbook	Field notes will be reviewed internally, at intervals as needed during the project and at the completion of the work, and placed in the project file. A copy of the field notes will be attached to the final report.	I	PQCM, Gilbane
Chain-of-custody forms	Chain-of-custody forms will be reviewed internally in the field upon completion and verified against the packed sample coolers they represent. The shipper's signature on the chain-of-custody form will be initialed by the reviewer. A copy of the form will be retained in the project file, and the original and remaining copies will be taped inside the cooler for shipment.	I I	PQCM, Gilbane Second-level review by Project Chemist, Gilbane
Sample receipt	For samples shipped to the lab via FedEx, the Project Chemist will verify receipt of samples by the laboratory the day following the shipment.	I	Project Chemist, Gilbane
Sample logins	Sample log-in information will be reviewed and verified for accuracy and completeness in accordance with the requirements in this SAP.	E[1]	Laboratory PM
Laboratory analytical results prior to release	Laboratory analytical results will be reviewed to verify that the requirements in this SAP have been met. Prior to release, results will be verified as follows:	E[1]	Laboratory PM
	• Analytical results (100 percent) comply with the method- and project-specific requirements, and any deviation or failure to meet criteria is documented for the project file.	E[1]	Laboratory PM
	• Manual entries (100 percent) are free of transcription errors, and manual calculations are accurate; computer calculations are spot-checked to verify program validity; results reported are compliant with method- and project-specific QC requirements; raw data and supporting materials are complete; spectral assignments are confirmed; descriptions of deviations from method or project requirements are documented; significant figures and rounding have been used appropriately; reported values include dilution factors; and results are reasonable.	E[1]	Analyst

SAP Worksheet #34 – Verification (Step I) Process Table (Continued)

(UFP-QAPP Manual Section 5.2.1)

Verification Input	Description	Internal / External	Responsible for Verification (name, organization)
Laboratory analytical results prior to release (Continued)	• Analytical results reported are compliant with method- and project-specific QC; analytical methods are implemented in compliance with approved SOPs. (This review may be conducted after release of results, since reviews are done only on 10 percent of the results.)	E[1]	Laboratory PM
Laboratory analytical results due at turnaround time listed on chain-of-custody record	Laboratory analytical results will be verified as having been obtained following the protocols in this SAP and being of sufficient quality to satisfy DQOs.	I	Project Chemist, Gilbane
Laboratory Data Packages	Screening data reports and Stage 3- or 4-equivalent laboratory data packages will be verified by the laboratory performing the work for completeness and technical accuracy prior to submittal, in accordance with the requirements described in SAP Worksheet #29.	E[1]	Laboratory PM
Field and electronic data	One-hundred percent of manual entries will be reviewed against the hard-copy information, and 5 percent of electronic uploads will be checked against the hard copy.	I	Project Chemist, Gilbane
Analytical Procedures	Ensure that the analytical methods and deliverable requirements described in this SAP were followed (including holding times, analyte lists, and QC criteria).	E[1]	Laboratory PM
Laboratory Data Reports	Ensure that data reports are validated by the laboratory performing the work for technical accuracy and for meeting the requirements listed in SAP Worksheet #29 prior to submittal.	E[1]	Laboratory PM

Notes:

[1]The Laboratory Project Manager may direct the use of a designee for verification inputs as needed.

SAP Worksheet #35 – Validation (Steps IIa and IIb) Process Table

(UFP-QAPP Manual Section 5.2.2) (Figure 37 UFP-QAPP Manual) (Table 9 UFP-QAPP Manual)

Step IIa / IIb	Validation Input	Description	Responsible for Validation (name, organization)
IIa	Sample Collection	Ensure that the sampling procedures described in this SAP were used to collect samples and that any deviations from those procedures were documented in a FCR.	PQCM, Gilbane Project Chemist, Gilbane
IIa	Sample Handling	Ensure that the procedures described in this SAP for sample handling, packaging, and transport to the laboratory were followed.	PQCM, Gilbane Project Chemist, Gilbane
IIa	Sample Documentation	Ensure that the chain-of-custody record procedures described in this SAP were followed for sample collection, and that logbooks or field forms were completed as required.	PQCM, Gilbane Project Chemist, Gilbane
IIb	Sampling Procedures	Review sampling procedures to document any deviations that occurred and note any corrective actions required.	PQCM, Gilbane
IIb	Analytical Procedures	Review analytical procedures to document any deviations that occurred and note any corrective actions required.	Site RSO or designee, Envirachem/Gilbane Project Chemist, Gilbane Third Party Validator, Validata
IIb	Project Quantitation Limits and Laboratory QC Criteria	Ensure that project quantitation limits and laboratory QC criteria were followed and that any deviations were documented.	Site RSO or designee, Envirachem/Gilbane Project Chemist, Gilbane Third Party Validator, Validata

Notes:
The Laboratory PM may direct the use of a designee for verification inputs as needed.

SAP Worksheet #36 – Analytical Data Validation (Steps IIa and IIb) Summary Table

(UFP-QAPP Manual Section 5.2.2.1)

Step IIa / IIb	Matrix	Analytical Group	Validation Criteria	Data Validator (title and organizational affiliation)
IIa	All	All	In accordance with Laboratory SOPs listed in SAP Worksheet #23 and the DoD QSM 5.1.1.	Site RSO or designee, Envirachem/Gilbane Project Chemist, Gilbane
IIb	All	All	In accordance with NAVFAC SW EWI #1, this SAP, and Gilbane SOP PR-TC-04.01.00.00 and PR-TC-04.01.02.00	Third-Party data validator, Project Chemist

The validation strategy for definitive data for this project is 90% Stage 2B and 10% Stage 3/4, in accordance with Step IIb above. The 10% will be randomly chosen on the chain-of-custody record. Definitive data does not include samples collected for informational purposes. Any such samples will be validated at a Stage 2A.

EPA Level IV Data Validation

EPA Level IV data validation is a full validation that will be performed on the TI Site 12 summary and raw data packages. The data reviewer will request any missing information from the laboratory and copy the Project Chemist when missing information is requested. The data reviewer will validate all components of the data package even when an individual QC element has been rejected. An overall final qualification of results will encompass the impact of individual findings and will be determined using the professional judgment of a senior data reviewer.

Level IV (Stage 3/4) Data Validation Elements

The QC elements to be reviewed for Level IV (Stage3/4) validation are listed below.

Radiological Analyses

- Holding times.
- Initial calibration.
- Continuing calibration.
- Blanks.
- Duplicate sample RPD or RER, as appropriate.
- Laboratory control sample recovery.
- Reporting limits and uncertainty.
- Review of reagent traceability summary, if applicable.

SAP Worksheet #36 – Analytical Data Validation (Steps IIa and IIb) Summary Table (continued)

- Calculation checks of quantified analytical data and QC samples.
- Overall assessment of data in the SDG.

Chemical Analyses

- Holding times and preservation.
- Blanks.
- Lab QC.
- Field QC, if applicable.
- Surrogates and internal standards, where applicable.
- Initial and continuing calibrations.
- Instrument performance checks.
- Review of raw data.
- Review of reagent traceability summary, if applicable.
- Calculation checks of quantified analytical data and QC samples.

EPA Level III (Stage 2B) Data Validation

EPA Level III (Stage 2B) data validation is a more cursory validation that will be performed on the summary packages (i.e., not on raw data). The data reviewer will request any missing information from the laboratory and copy the client's project manager when missing information is requested. The data reviewer will validate all components of the data package, even when an individual QC element has been rejected. An overall final qualification of results will encompass the impact of individual findings and will be determined using the professional judgment of a senior data reviewer.

Level III (Stage 2B) Data Validation Elements

The QC elements to be reviewed for Level III validation are listed below.

Radiological Analyses

- Holding times.
- Initial calibration.
- Continuing calibration.
- Blanks.
- Duplicate sample RPD or RER, as appropriate.
- Laboratory control sample recovery.
- Reporting limits.
- Overall assessment of data in the SDG.

SAP Worksheet #36 – Analytical Data Validation (Steps IIa and IIb) Summary Table (continued)

Chemical Analyses

- Holding times and preservation.
- Blanks.
- Lab QC.
- Field QC, if applicable.
- Surrogates and internal standards, where applicable.
- Initial and continuing calibrations.
- Instrument performance checks

The following documents will be used as guidance for validating chemical analytical results:

- *General Data Validation Guidelines* (DoD, 2018)
- *Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review*, EPA 540-R-2017-002 (EPA, 2017).
- *Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review*, EPA 540-R-2017-001 (EPA, 2017).
- EWI #1, 3EN2.1, Chemical Data Validation (SWDIV2001).
- *Test Methods for Evaluating Solid Waste, Physical Chemical Methods*, SW-846, Third Edition and final updates (EPA, 1986).
- QSM v. 5.1 (DoD/Department of Energy [DOE], 2017).
- QC criteria specified in this SAP.

Radiological analytical results will be validated using Chapter 8 of the *Multi-Agency Radiological Laboratory Analytical Protocols Manual* (MARLAP), EPA 402-B-04-001A (EPA et al., 2004); and the QC criteria specified in the SAP.

SAP Worksheet #37 – Usability Assessment

(UFP-QAPP Manual Section 5.2.3)

After the analytical results have been reviewed, verified, and validated in accordance with SAP Worksheets #34 through #36, a Quality Control Summary Report (QCSR) will be prepared as an appendix to the Removal Action Completion Report to assess data quality and usability. The QCSR will include review of the following, and will include enough information to support the data usability conclusions:

- Sample collection and analytical methods to verify that these were performed as discussed in SAP Worksheets #14 and #17.
- Project-specific QLs as listed in SAP Worksheets #15.1 through #15.18 to verify that project-specific remedial goals were met for each sample.
- DQOs to determine whether they have been achieved by the data collected.
- Project-specific data quality indicators for precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) parameters (including, but not limited to, assessment of analytical DQOs) as discussed below.

Precision

Precision is defined as the degree of mutual agreement between individual measurements of the same property under similar conditions, and provides a measurement of the reproducibility of an analytical result. Precision will be evaluated through the analysis of field duplicate samples, LCS and LCSD (if LCSD is run), and MS/MSD samples, as applicable (see SAP Worksheet #20). QC criteria failures will be documented in the case narrative and included in the Comprehensive Analytical Report from the analytical laboratory. The precision measurement will be determined using the RPD or RER between the duplicate sample results as follows:

$$RPD = \frac{|A-B|}{(A+B)/2} \; x \; 100\%$$

where: A = First duplicate concentration
B = Second duplicate concentration

RER = (result activity – duplicate activity)/(sample uncertainty + duplicate uncertainty)
using 2 sigma propagated uncertainty

As applicable, the RPD or RER limits for laboratory duplicates, MSDs, and LCSDs are presented in SAP Worksheet #28. Associated samples that do not meet the criteria will be evaluated by the validator.

Field duplicate precision will be evaluated for chemical and radiological analyses for those concentrations 5 times the reporting limit using the RPD presented on SAP Worksheet #12. For those concentration less than 5 times the reporting limit, the precision for chemical analyses will be evaluated by a “reporting limit check” in which the difference in concentration between the duplicate and the parent sample is compared to the reporting limit as the criterion. Field

SAP Worksheet #37 – Usability Assessment (Continued)

duplicate precision for gamma spectrometry with concentrations near the MDC will be evaluated using an RER criterion of less than or equal to 1.

For the MS and the MSD, sample heterogeneity and the presence of interfering compounds often negatively affect the precision of the analysis. Also, the presence of high levels of target compounds in the sample chosen for spiking may necessitate a dilution of the sample, or may otherwise result in errors in spiked compound recovery. For these reasons, MS samples may not be truly representative of the precision of the analytical process. When the RPD obtained from the results of MS/MSD are out of criteria and the RPD of the LCS/LCSD is within criteria, the poor variance is attributed to the matrix of the sample and the effect on the project objectives has to be considered.

The overall precision will be discussed in the QCSR. If the precision is poor, the impacted data will be qualified as described in the EPA National Functional Guidelines. The impact will be documented along with the rationale for re-sampling or the limited or unlimited use of the data.

Accuracy

Accuracy is the degree of agreement between an analytical measurement and a reference accepted as a true value. The accuracy of a measurement system can be affected by errors introduced by field contamination, sample preservation, sample handling, sample preparation, or analytical techniques. A program of sample spiking will be conducted to evaluate laboratory accuracy. Accuracy will be evaluated by the percent recovery of the spiked compounds in the LCS, LCS duplicate, and MS/MSD samples. LCS and MS samples will be spiked prior to extraction with the method target compounds indicated in this SAP. MS/MSD and LCS or blank spike samples will be analyzed at a frequency of 5 percent or one per sample delivery group/analytical batch (sample sets are about 10 samples). The results of the spiked samples will be used to calculate the percent recovery for evaluating accuracy, using the following equation:

$$\text{Percent Recovery} = \frac{S - C}{T} \times 100$$

where:

S	=	Measured spike sample concentration
C	=	Sample concentration
T	=	True or actual concentration of the spike

SAP Worksheet #28 presents accuracy goals for this investigation based on the percent recovery of matrix and surrogate spikes. Results that fall outside the accuracy goals will be further evaluated on the basis of other QC samples.

For MS and MSD, sample heterogeneity and the presence of interfering compounds often negatively affect the accuracy and precision of the analysis. Also, the presence of high levels of target compounds in the sample chosen for spiking may necessitate a dilution of the sample, or may otherwise result in errors in spiked compound recovery. For these reasons, MS/MSD

SAP Worksheet #37 – Usability Assessment (Continued)

samples may not be truly representative of the accuracy and/or precision of the analytical process.

If MS/MSD analyses do not meet the specified recovery criteria, the recoveries from the LCS will be evaluated. If the LCS accuracy criteria are met, the failure of the MS/MSD will be attributed to interference from the sample matrix, and no corrective action will be required. If the LCS accuracy criteria are not met, the associated primary and QC samples will be re-prepared and re-analyzed.

In cases where re-preparation and re-analysis of the samples is not possible, the QC criteria failures will be documented in the case narrative and included in the Comprehensive Analytical Report. The affected data will be qualified as described the guidelines described in SAP Worksheet #36, and the impact of the QC failures on the DQOs for the project will be assessed in the final report.

Trend Analysis for Precision and Accuracy

For each analytical method, the laboratory uses the MS/MSD and LCS/LCSD data to track and analyze trends in the laboratory. From these trends they can recognize deficiencies in the method and create in-house acceptance criteria. For this project, the limits are based on the most recent version of the DoD QSM if available. For methods where the limits are not available, the project criteria default to the laboratory criteria based on their tracked trending.

The precision and accuracy of the entire data set is used to determine if any systemic problems have occurred during the sampling event that will result in deficiencies in the data set. The occurrence of systemic problems and the resulting consequences will be discussed in the QCSR. The data reviewer will make every effort to identify any critical elements or trends that would result in non-usability of data as early as possible.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent the characteristics of a population, variations in a parameter at a sampling point, or an environmental condition that they are intended to represent. For this project, representative data will be obtained through careful selection of sampling locations and analytical parameters. Representative data also will be obtained through proper collection and handling of samples to avoid interference and minimize cross-contamination. Representativeness of data will also be ensured through consistent application of the appropriate established field and laboratory procedures. To aid in evaluating the representativeness of the sample results, field and laboratory blank samples will be evaluated for the presence of contaminants. Laboratory procedures will be reviewed to verify that standard operating procedures were followed and method requirements were met during the analysis of project samples. Laboratory sample storage practices, holding times, sub-sampling procedures, method blanks, and evidence of matrix interference will be assessed for potential impacts on the representativeness of the data.

SAP Worksheet #37 – Usability Assessment (Continued)

Data determined to be non-representative will be used only if accompanied by appropriate qualifiers and limits of uncertainty.

Representativeness as it relates to field procedures refers to the collection of samples that allow accurate conclusions to be made regarding the composition of the sample media at the entire site. Representativeness will be assessed qualitatively by evaluating whether the procedures described in this SAP were followed. The site-sampling layout, including sampling locations, frequency of sampling, and timing of sampling activities, will be reviewed.

Completeness

Completeness is a measure of the percentage of project-specific data that are valid. Valid data are obtained when samples are collected and analyzed in accordance with the QC procedures outlined in this SAP and when none of the QC criteria that affect data usability is exceeded. When data validation is completed, the percent completeness value will be calculated by dividing the number of useable sample results by the total number of sample results planned for this investigation. The evaluation of completeness will help determine whether any limitations are associated with the decisions to be made based on the data collected.

Completeness will be evaluated by reviewing the tasks that contribute to the sampling event, such as chain-of-custody procedures, adherence to the Work Plan, and adherence to this Sampling and Analysis Plan. The QC parameters to be evaluated in determining completeness include holding times, initial calibrations, continuing calibrations, surrogate recoveries, LCS recoveries, MS/MSD recoveries and RPDs, and laboratory duplicate RPDs. Completeness will be calculated based on the number of individual results (i.e., per analyte). The completeness goal for this project is 95%.

Comparability

Comparability expresses the confidence with which one dataset can be compared with another. Comparability of data will be achieved by consistently following standard field and laboratory procedures and by using standard measurement units in reporting analytical data. Analytical methods selected for this field investigation are consistent with the methods used during previous investigations of this type. To ensure the comparability of laboratory data, the contract laboratory will use standard test methods and means of sample preservation; standard units, detection limits, calculation procedures, and reporting formats; and standard measures of accuracy and precision. Only laboratories that have been approved by the DoD ELAP will perform chemical analyses of environmental samples to produce definitive data in support of this CTO.

Sensitivity

The DL, LOD, and LOQ will be evaluated by the project team prior to sample analysis to determine if the laboratory is able to attain the required sensitivity for the project. If project decision limits are too sensitive, it will be determined prior to sample analysis whether a

SAP Worksheet #37 – Usability Assessment (Continued)

sensitivity variance will be issued to the laboratory based on the method chosen and the technology available.

The DL is the minimum quantity of an analyte that can be reliably distinguished from background noise or from zero for a specific analytical method at a 99 percent confidence level. The DL protects against false positives. The LOD is the minimum quantity of an analyte that can be reliably detected for a specific analytical method at a 99 percent confidence level that the value is not a false negative. The LOD should be equivalent to the concentration of the DL verification standard. The LOQ represents the smallest quantity of an analyte that can be accurately and reproducibly quantified in a given sample matrix (e.g., three to five times the LOD). For this project, the minimum detectable concentration (MDC) pertains only to radiological analyses, defined as follows in accordance with the Multi-Agency Radiological Laboratory Analytical Protocols: the MDC is calculated as a sample specific value and typically these values assume both a Type I (α) and Type II (β) error of 5 percent. The LOD and/or the LOQ and MDC should be sensitive enough to meet the project decision limits (e.g., PSLs). The LOD , LOQ and MDC will be evaluated after sample analysis to determine if there were any matrix effects, operator errors, or analytical process errors that interfered with the ability to compare the results to the project decision limits. The LOD and MDC (as applicable) will be used to determine if no detectable amounts of contaminants of concern are present. If no detectable amounts are reported and all data are acceptable from the verification and validation, then the data is usable. The DL will be used to determine if any detectable amounts of contaminants of concern are present. If detectable amounts are reported and the verification and validation are acceptable, then the data is usable. Any detection falling between the DL and LOQ are qualified as estimated. If anomalies in sensitivity are present, the rationale for use or non-use of the affected samples will be discussed in the QCSR. Worksheet #15 presents the laboratory DL, LODs, LOQs, and MDCs (as applicable) for the selected analytical method(s) used to support the project decision limits.

FIGURES

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NAVFAC Naval Facilities Engineering Command

IR Site 12 Non-SWDA Remedial Action/
SWDA Removal Action
Former Naval Station Treasure Island
San Francisco, CA

Figure 1
Treasure Island Location Map

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NAVFAC Naval Facilities Engineering Command

IR Site 12 Non-SWDA Remedial Action/
SWDA Removal Action
Former Naval Station Treasure Island
San Francisco, CA

Figure 2
IR Site 12
Non-SWDA Remedial Action Map

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NAVFAC Naval Facilities Engineering Command

IR Site 12 Non-SWDA Remedial Action/
SWDA Removal Action
Former Naval Station Treasure Island
San Francisco, CA

Figure 3
IR Site 12 North Point
SWDA NTCRA Map

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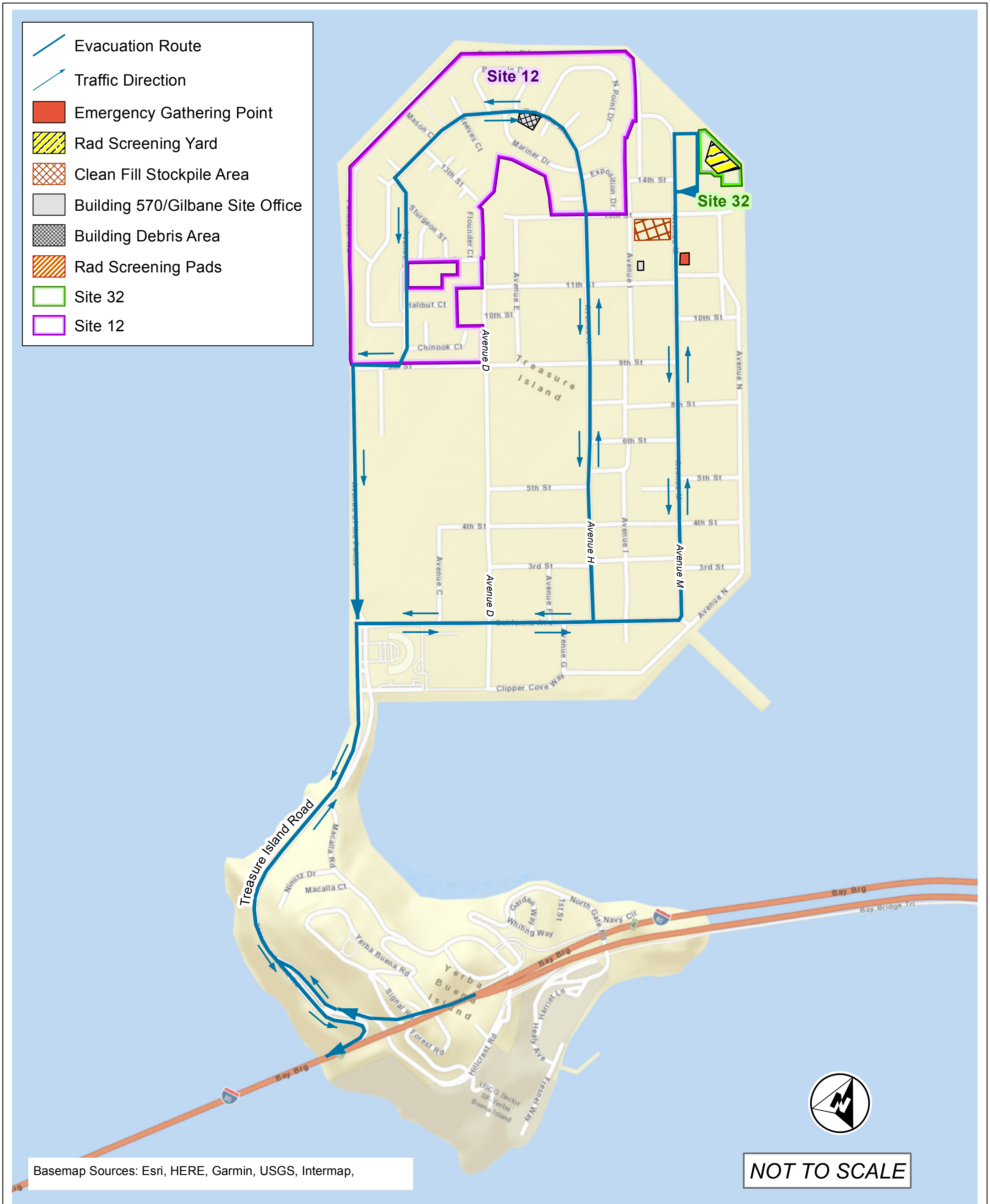

IR Site 12 Non-SWDA Remedial Action/
SWDA Removal Action
Former Naval Station Treasure Island
San Francisco, CA

NAVFAC Naval Facilities Engineering Command

Figure 4
IR Site 12
Truck Route Map

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NAVFAC Naval Facilities Engineering Command

IR Site 12 Non-SWDA Remedial Action/
SWDA Removal Action
Former Naval Station Treasure Island
San Francisco, CA

Figure 5
Gateview Arsenic/TPH Area
Groundwater Monitoring Well Map

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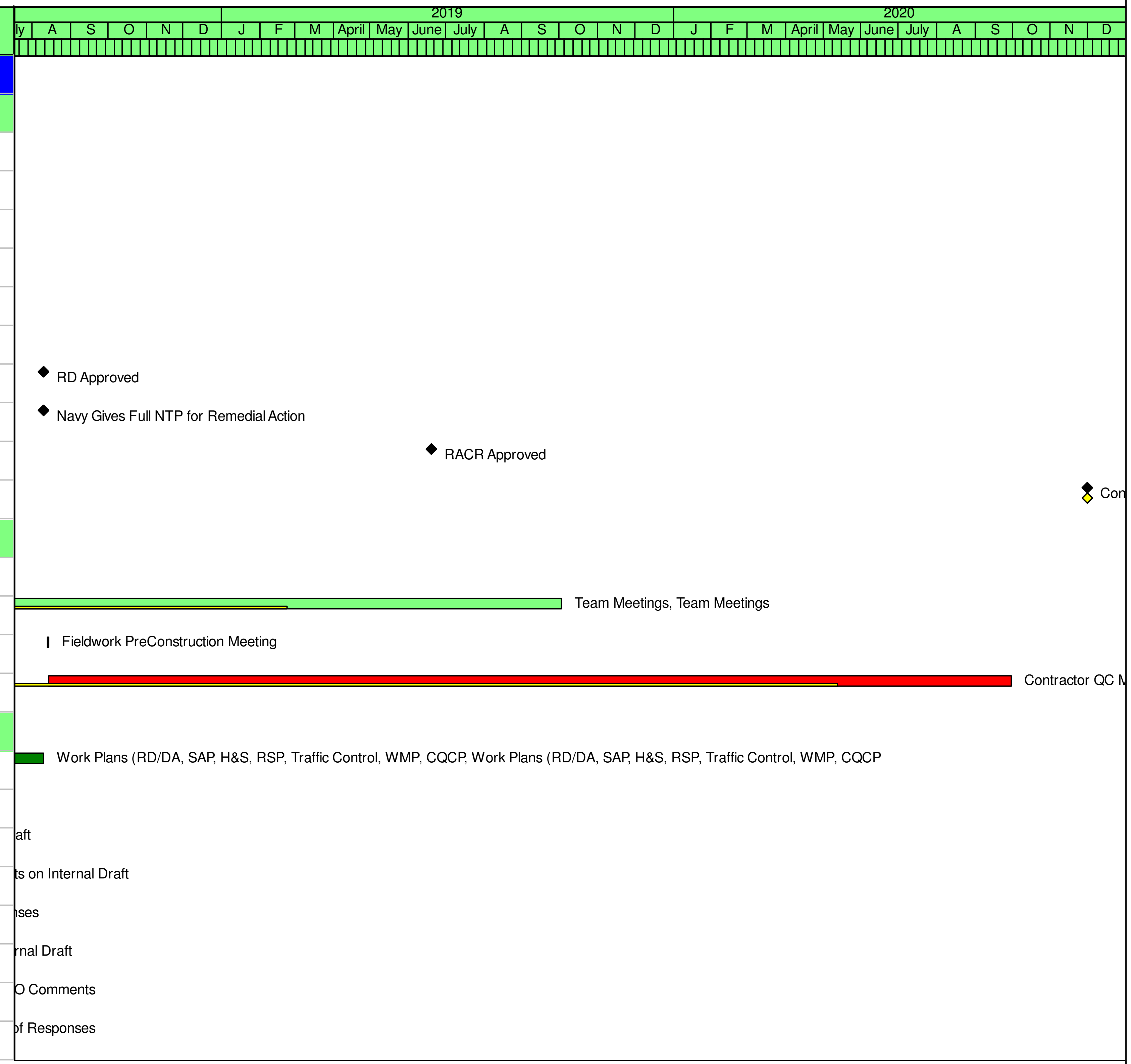
Figure 6 Project Schedule

Data Date - 16-Jul-18 Run Date - 16-Jul-18

Activity ID	Activity Name	At Completion Duration	Start	Finish
RADMAC II - Treasure Island				
Milestones				
MS0100	Contract Award	0	02-Aug-17 A	
MS0200	Submit Schedule and Agenda	0	15-Aug-17 A	
MS0300	Kick-off Meeting	0	15-Aug-17 A	
MS0400	Navy Gives 90-Day Notice to Bldg 1126 & 1217 Occupants	0	15-Aug-17 A	
MS0500	Navy Gives Limited NTP for PreRemedial Action Activities	0	15-Aug-17 A	
MS0600	Award of IDIQ Items	0	22-Sep-17 A	
MS0700	RD Approved	0	10-Aug-18	
MS0800	Navy Gives Full NTP for Remedial Action	0	10-Aug-18	
MS0900	RACR Approved	0	19-Jun-19	
MS1000	Contractural POP Date	0		30-Nov-20*
Project Management				
PM0100	Contract Kick-off Meeting	0	15-Aug-17 A	15-Aug-17 A
PM0200	Team Meetings	534	15-Aug-17 A	02-Oct-19
PM0300	Fieldwork PreConstruction Meeting	1	13-Aug-18*	13-Aug-18
PM0400	Contractor QC Meetings	534	14-Aug-18*	30-Sep-20
Project Plans				
PP0100	Work Plans (RD/DA, SAP, H&S, RSP, Traffic Control, WMP, CQCP	247	15-Aug-17 A	10-Aug-18
PP0110	Internal Draft	49	15-Aug-17 A	24-Oct-17 A
PP0120	Navy/BRAC/RASO Review of Internal Draft	54	25-Oct-17 A	18-Dec-17 A
PP0125	Response to BRAC/RASO Comments on Internal Draft	25	14-Dec-17 A	07-Jan-18 A
PP0126	BRAC/RASO Approve Responses	33	07-Jan-18 A	08-Feb-18 A
PP0127	Navy/QAO Review Internal Draft	34	09-Feb-18 A	14-Mar-18 A
PP0128	Response to Navy/QAO Comments	5	14-Mar-18 A	19-Mar-18 A
PP0129	Navy/QAO Approval of Responses	6	20-Mar-18 A	26-Mar-18 A



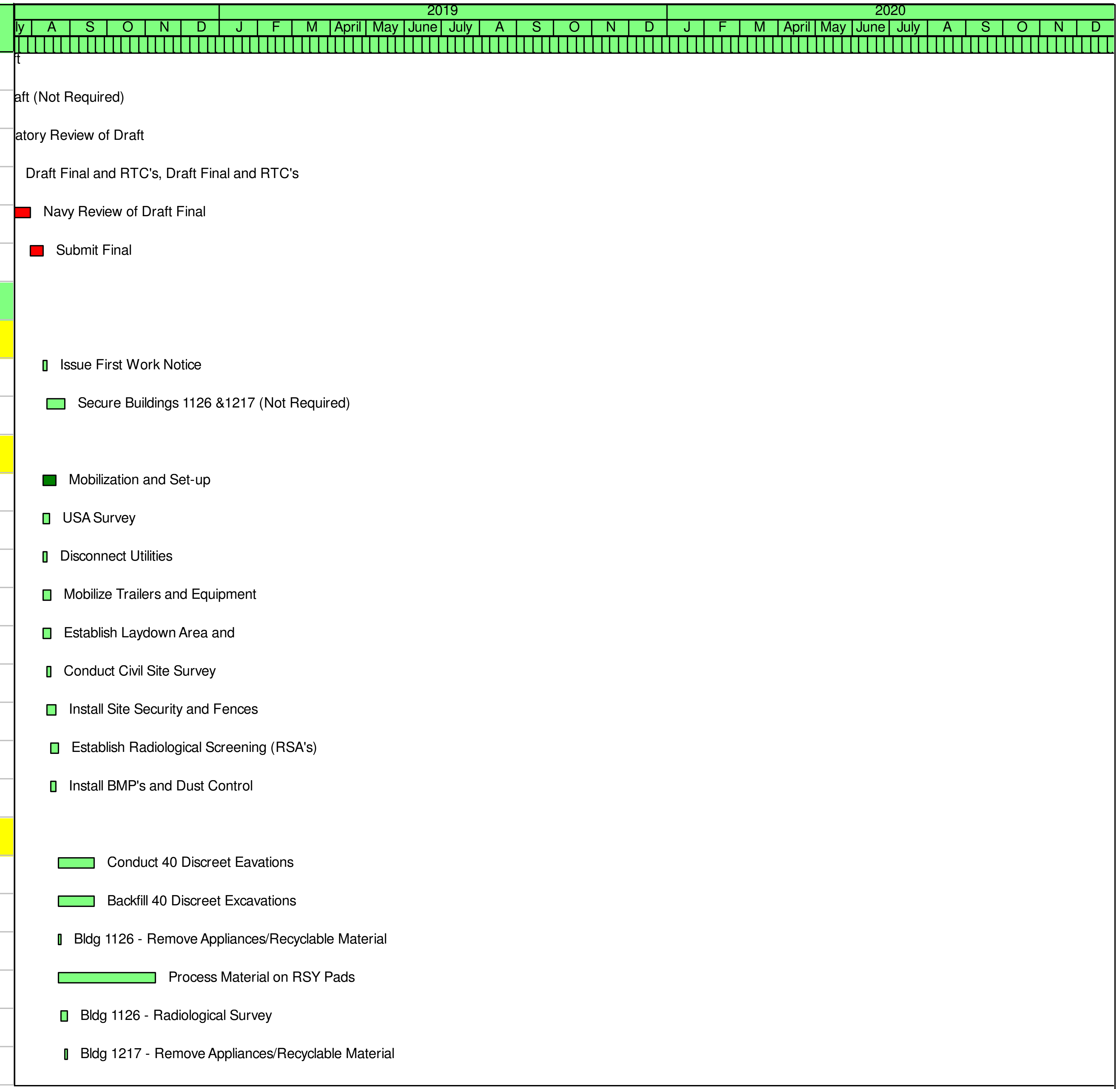
Remaining Level of Effort
Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work
Milestone
Project Baseline
Project BL Milestones

RADMAC II TREASURE ISLAND
July 16, 2018 Master Schedule
1 of 4

Gilbane

Figure 6 Project Schedule

Activity ID	Activity Name	At Completion Duration	Start	Finish
PP0130	Preparation of Draft	6	27-Mar-18 A	04-Apr-18 A
PP0140	Navy Review of Draft (Not Required)	0	05-Apr-18 A	05-Apr-18 A
PP0150	Regulatory Review of Draft	65	05-Apr-18 A	08-Jun-18 A
PP0160	Draft Final and RTC's	35	11-Jun-18 A	16-Jul-18
PP0170	Navy Review of Draft Final	10	16-Jul-18	30-Jul-18
PP0180	Submit Final	9	30-Jul-18	10-Aug-18
Remedial Action Implementation				
Pre-Remedial Actions				
PRE0100	Issue First Work Notice	1	10-Aug-18	13-Aug-18
PRE0200	Secure Buildings 1126 &1217 (Not Required)	10	13-Aug-18	27-Aug-18
Mobilization				
MM0100	Mobilization and Set-up	6	10-Aug-18	20-Aug-18
MM0110	USA Survey	3	10-Aug-18	15-Aug-18
MM0120	Disconnect Utilities	1	10-Aug-18	13-Aug-18
MM0140	Mobilize Trailers and Equipment	4	10-Aug-18	16-Aug-18
MM0150	Establish Laydown Area and	4	10-Aug-18	16-Aug-18
MM0130	Conduct Civil Site Survey	3	13-Aug-18	16-Aug-18
MM0170	Install Site Security and Fences	5	13-Aug-18	20-Aug-18
MM0160	Establish Radiological Screening (RSA's)	4	16-Aug-18	22-Aug-18
MM0180	Install BMP's and Dust Control	2	16-Aug-18	20-Aug-18
Remedial Action				
RA0100	Conduct 40 Discreet Eavations	20	22-Aug-18	20-Sep-18
RA0120	Backfill 40 Discreet Excavations	20	22-Aug-18	20-Sep-18
RA0130	Bldg 1126 - Remove Appliances/Recyclable Material	2	22-Aug-18	24-Aug-18
RA0220	Process Material on RSY Pads	55	22-Aug-18	09-Nov-18
RA0140	Bldg 1126 - Radiological Survey	3	24-Aug-18	29-Aug-18
RA0170	Bldg 1217 - Remove Appliances/Recyclable Material	2	27-Aug-18	29-Aug-18



Remaining Level of Effort ◆ ◆ Milestone
Actual Level of Effort — Project Baseline
Actual Work ◇ ◇ Project BL MIlestones
Remaining Work
Critical Remaining Work

RADMAC II TREASURE ISLAND
July 16, 2018 Master Schedule

Gilbane

Figure 6 Project Schedule

Activity ID	Activity Name	At Completion Duration	Start	Finish
RA0150	Bldg 1126 - Remove ACM	7	29-Aug-18	10-Sep-18
RA0180	Bldg 1217 - Radiological Survey	3	30-Aug-18	05-Sep-18
RA0160	Bldg 1126 - Structural Demolition	6	10-Sep-18	18-Sep-18
RA0190	Bldg 1217 - Remove ACM	6	11-Sep-18	19-Sep-18
RA0200	Bldg 1217 - Structural Demolition	6	19-Sep-18	27-Sep-18
RA0210	Excavate Below Buildings	6	21-Sep-18	01-Oct-18
RA0230	Import Backfill and Regrade	25	01-Oct-18	06-Nov-18
RA0240	HydroSeed and Landscape	2	06-Nov-18	08-Nov-18
Waste Characterization, Transportation and Disposal				
RA0250	Soil Characterization, Transportation and Disposal	64	22-Aug-18	27-Nov-18
RA0270	ACM Characterization, Transportation and Disposal	20	29-Aug-18	27-Sep-18
RA0260	Building Material Characterization, Transportation and Disposal	13	10-Sep-18	27-Sep-18
Continuation of NTCRA Field Activities				
RA0280	Transportation and Disposal of Stockpiled 4000 cu yds	10	20-Aug-18	04-Sep-18
RA0290	Install BMP's	1	20-Aug-18	21-Aug-18
RA0300	Excavation at Bayside/Northpoint Soild Waste Area	28	21-Aug-18	01-Oct-18
RA0310	Survey RSY Pads	55	21-Aug-18	08-Nov-18
RA0340	Profiling IDW	25	21-Aug-18	26-Sep-18
RA0350	Transportation of IDW	35	26-Sep-18	16-Nov-18
RA0320	Backfill & Site Restoration	31	02-Oct-18	16-Nov-18
GW Monitoring Wells at Gateway Arsenic				
GW0100	Install 5 New Wells (Not Required)	5	26-Sep-18	03-Oct-18
GW0200	Sample 15 Wells	4	03-Oct-18	10-Oct-18
Demobilization and Close-out				
DM0100	Survey and Sample RSY Pads	4	08-Nov-18	15-Nov-18
DM0110	Remove and Dispose of RSY Pads	5	15-Nov-18	26-Nov-18
DM0120	Conduct final GWS	4	26-Nov-18	30-Nov-18

2019: J F M April May June July A S O N D
2020: J F M April May June July A S O N D

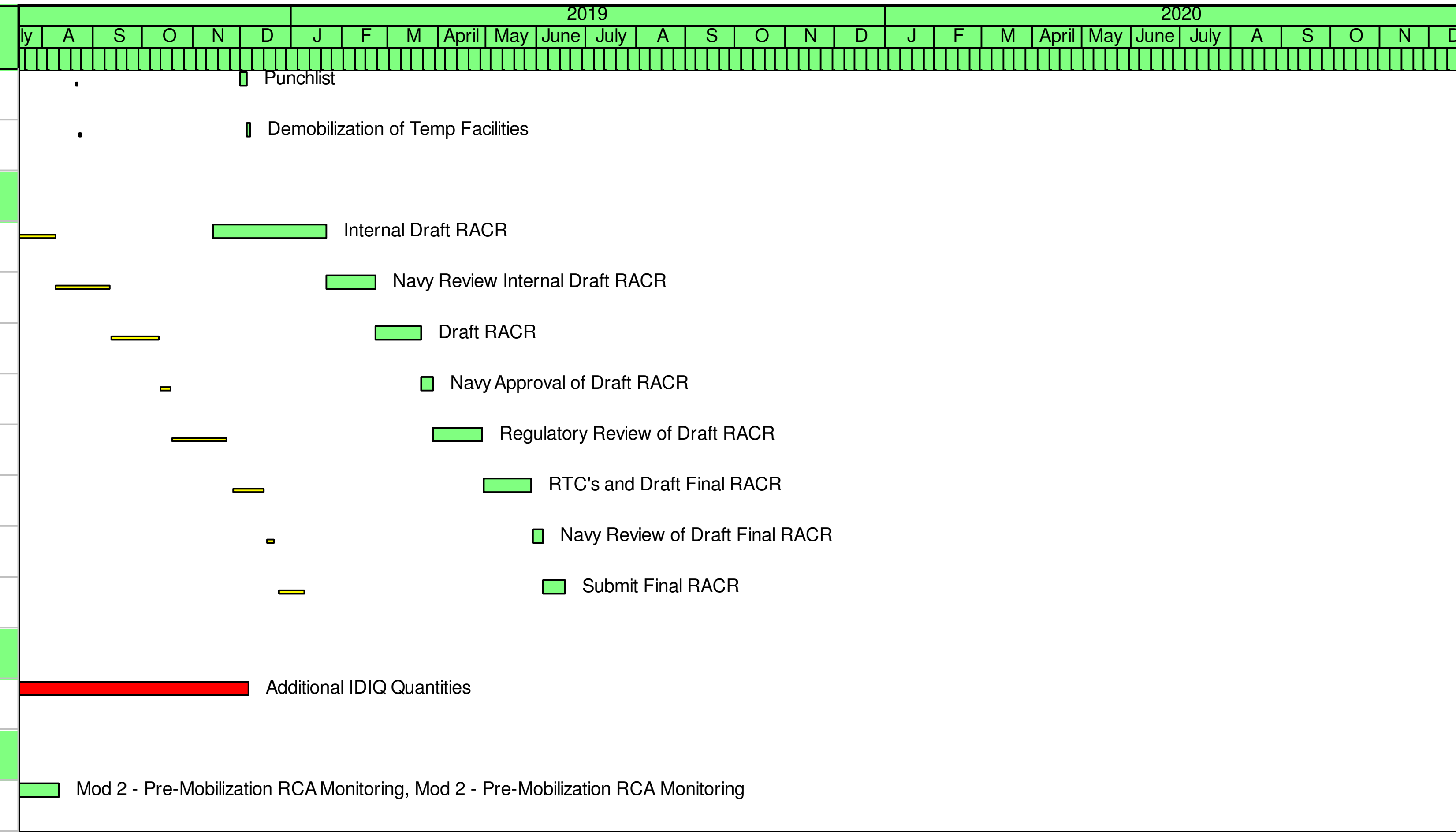
Remaining Level of Effort
Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work
Milestone
Project Baseline
Project BL Mllestones

RADMAC II TREASURE ISLAND
July 16, 2018 Master Schedule

Gilbane

Figure 6 Project Schedule

Activity ID	Activity Name	At Completion Duration	Start	Finish
DM0130	Punchlist	2	30-Nov-18	04-Dec-18
DM0140	Demobilization of Temp Facilities	2	04-Dec-18	06-Dec-18
Reports and Data Submission				
RC0100	Internal Draft RACR	45	13-Nov-18	22-Jan-19
RC0110	Navy Review Internal Draft RACR	30	22-Jan-19	21-Feb-19
RC0120	Draft RACR	21	21-Feb-19	22-Mar-19
RC0130	Navy Approval of Draft RACR	5	22-Mar-19	29-Mar-19
RC0140	Regulatory Review of Draft RACR	30	29-Mar-19	28-Apr-19
RC0150	RTC's and Draft Final RACR	21	29-Apr-19	28-May-19
RC0160	Navy Review of Draft Final RACR	5	29-May-19	04-Jun-19
RC0170	Submit Final RACR	10	05-Jun-19	18-Jun-19
MOD 1 - Additional IDIQ Quantities				
IDIQ0010	Additional IDIQ Quantities	98	16-Jul-18*	05-Dec-18
MOD 2 - Early Establishment of RCA Monitoring				
MOD2 001	Mod 2 - Pre-Mobilization RCA Monitoring	103	19-Mar-18 A	10-Aug-18



Remaining Level of Effort
Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work
Milestone
Project Baseline
Project BL MIlestones

RADMAC II TREASURE ISLAND
July 16, 2018 Master Schedule
4 of 4

Gilbane

ATTACHMENT A
Gilbane Standard Operating Procedures

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Gilbane

Standard Operating Procedure

Field Documentation

PR-TC-01.04.01.00 v3

Reviewed by:	Kristen Carlyon Peyton, Senior Chemist	Date:	15 Jul 2015
Reviewed by:	Laura Tryboski, Environmental QA/QC Manager	Date:	15 Jul 2015
Approved by:	Jeffrey Hess, Director Technical Services	Date:	15 Jul 2015

Review / Revision History:

Version	Changes	Affects Section/Pages	Date	Approval*
1.0	Initial Issue	NA	14 Mar 2011	NA
2.0	Updated and revised documentation requirements, and instructions for uploading completed daily field documents to eDMS and project servers.	All pages	05 Jun 2013	NA
3.0	Updated entire procedure. Edits completed by EBU Quality Council	All pages	10 Jul 2015	NA

- Approval required for reviews and minor changes only. Substantive revisions to the technical requirements contained in the SOP require review and approval by the signatories to the SOP.

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Table of Contents

List of Attachments

1.0 PURPOSE AND SCOPE

This standard operating procedure (SOP) provides an overview of required field documentation to be performed as part of an environmental site visit or field activity performed by Gilbane Federal (Gilbane). This documentation occurs through the use of specific field forms identified herein, and the use of other forms applicable to specific work activities that may be performed, as identified in SOPs, project specific plans, or by the client.

Complete documentation of field activities is a crucial part of any field activities, both for technical and legal defensibility. This SOP addresses the following field documents:

- Daily Activity Report (Section 4.1),
- Contractor Production Report (Section 4.2)
- Photo Documentation (Section 4.3)
- Field Change Request (Section 4.4)
- Health and Safety Forms (Section 4.5)
- Quality Control Forms (Section 4.6)
- Project Specific Forms (Section 4.7)
- Federal, State and Local Agency Forms (Section 4.8)

2.0 ACRONYMS

For purposes of this procedure, a number of terms and acronyms have the meanings defined below.

APP: Accident Prevention Plan
CPR: Contractor Production Report
CQCP: Contractor Quality Control Plan
DAR: Daily Activity Report
DMS: Document Management System
DoD: Department of Defense
eDMS: environmental data management system
FCR: Field Change Request
FTL: Field Team Leader
GPS: global positioning system
HSP: Health and Safety Plan
PM: Project Manager
PgM: Program Manager
IDW: investigation-derived waste
QA: Quality Assurance
QCM: Quality Control Manager
SCL: Sample Collection Log

SAP: Sampling and Analysis Plan

SOP: Standard Operating Procedure

3.0 EQUIPMENT/MATERIALS

The list below represents the equipment and materials recommended to complete the tasks defined in the SOP:

- Daily Activity Report (DAR);
- Other field forms as appropriate for the project, including but not limited to:
    - Contractor Production Report (CPR)
    - Photo Log
    - Field Change Request
    - Health and safety forms
    - Quality control forms
- Indelible pen (fine-tip preferable).
- Camera (Global Positioning System [GPS] enabled if possible)
- GPS Equipment (if not included in camera or if greater precision needed)
- Wireless-enabled laptop or tablet

4.0 PROCEDURES

The Project Manager and assigned field staff shall schedule a kickoff meeting to establish expectations for record keeping of the project. The meeting shall include discussion of the project schedule, field activities, roles and responsibilities, work phases, field procedures, specific field forms, and record keeping processes. The expectations outlined in this meeting should be shared with all staff involved in the meeting who are responsible for documenting any aspect of the project.

The following items are applicable to completion of field documentation:

- Field documentation is kept to record the activities conducted on a project site. It is the official proof of work performed and, therefore, must be completed in its entirety with clear and accurate statements. The documentation should be completed the day the work is performed.
- Field documents must be completed using indelible ink (preferably black or blue color) and writing must be legible. Use of a computer or digital recorders may be used to complete documents only if specifically allowed for a given project, if permissible by program and client requirements, and with prior approval of the Project Manager (PM), Program Manager (PgM), and Quality Control Manager (QCM).
- All fields on forms shall be completed. Notes to reflect non-applicability (N/A), data not collected, etc., shall be used to clarify field activities. Blank spaces after end of notes or last data entry shall be lined out with a single line with the preparer's initials and date placed next to the line.

- Any errors made shall be corrected by striking out the error with a single line and placing the initials of the corrector and date next to the line. The correction is written next to the lined out error or provided on an attached page, as applicable.
- If an error is observed after the document has been finalized and/or submitted to the client, corrections shall be noted on a separate copy of the document or on a separate blank page. An explanation to describe the error and how it was corrected should be provided on the new page. The new page shall be attached to the original document and resubmitted to the original distribution of recipients and to project files.
- Documents requiring approval shall have the approver's name printed and signature completed in ink or attached as a password protected electronic signature (i.e. adobe software signature).
- The Gilbane logo is used on all field forms with the exception of Health and Safety and Quality Department forms. The Gilbane Federal logo is used to differentiate those forms from similar Gilbane Building Company forms.
- Field personnel shall adhere to the field reporting protocol, and ensure that all entries are recorded in a manner consistent with this SOP.

The following sections discuss the basic forms required for most environmental projects; be sure to consult other project specific documents (e.g. Sampling and Analysis Plan; Construction Quality Control Plan; and Health and Safety Plan, etc.) and the project contract for other required forms.

4.1 DAILY ACTIVITY REPORT

The DAR documents the daily activities and is considered the official representation of field operations. Accurate record keeping supports the production of periodic and final client reports, transferring information to project team members and legal defensibility of work.

Each Field Team Leader (FTL), Task Manager, or Site Superintendent overseeing or conducting field activities shall be responsible for completing and maintaining a DAR to document the activities performed each day in the field. For field operations with multiple activities being conducted, a DAR shall be generated by each FTL. A copy of the DAR is provided in Attachment A.

At a minimum the following information shall be recorded in the DAR:

- Project name and project job and phase code
- Site name and location
- Date(s) of field activity
- Name of individual reporting field notes
- Name, affiliation, and responsibilities of the personnel (both Gilbane and subcontractors) on site. For larger projects with significant field staff, this information may be entered into the CPR (discussed in Section 4.2)
- Arrival and departure times
- Daily weather conditions

- Chronology and location of field activities
- Pertinent field observations, including:
    - Physical description and sketch or map of the field activity location (to include details such as structures, sample points, borings, wells, stained areas, and any other pertinent information).
    - References to GPS data collected, if applicable (note, all locations where information is collected (such as sample locations, water quality testing locations, photographs of key features) should be located using a GPS).
    - References to photographs of the site and site activities, as applicable, including reference to photo log (see Section 4.3) or location, digital file number (if available) and direction faced when taken.
- Record of relevant daily telephone calls, project e-mails, and/or direct contact with individuals at the site (or offsite) where direction may have been received (e.g., from client, program or project management), comments or requests received from regulators, or issues brought up by subcontractors.

Other pertinent information should be included, with the specific nature of this information dependent on the type of field activity. For example, if the field activity involved the collection of samples for environmental or geotechnical analysis, relevant information to include in the DAR (or field logbook, when applicable) would consist of the following:

- Daily summary of equipment preparation procedures, as appropriate.
- A description of sampling methodology and type of equipment used.
- Time and locations of sample collection (unless reported in an appropriate Sample Collection Log [SCL]. If SCLs are used, reference the accompanying SCLs in the DAR and the focus of the DAR should then be on summarizing the day's activities–an example of the appropriate level of detail would be "Sampled MW-1 and MW-4…").
- Number of and type of samples collected, and sample identification numbers (unless reported in SCLs and summarized in the accompanying Sample Tracking Log. If SCLs are used, the emphasis should be on summarizing the day's production).
- Management and disposal of investigation-derived wastes (IDW). Describe type and quantities (approximate or known) of IDW generated, stored and disposed. Document the location, markings/postings, type of container and container number (unless using a IDW/Waste Inventory Form. If inventory form is used, just summarize information on DAR).

4.1.1 Field Logbook

Specific field programs, sites, regulatory or weather conditions may necessitate the use of bound field logbooks in addition to or in lieu of completing DAR forms.

- There are several types of acceptable logbooks, depending on the requirements of the field activity. One of two types of logbooks are recommended, if used: 1) permanently bound, sequentially numbered, pocket-sized logbook with water-resistant paper; or 2) custom logbook consisting of approved forms printed on water-resistant paper and spiral-bound to prevent pages from being added or removed in the field. Other options exist, but care should be taken if alternate logbooks are used to make sure the selection is consistent with the underlying requirement for use of a logbook in place of a DAR.

- Each page of the field logbook will be sequentially numbered and dated. When using field logbooks, all entries shall be legible and each day will be documented in chronological order, reflecting the order of each day's activities as they transpire. Unused partial pages (i.e., at the end of each workday) should be crossed-out, signed and dated. If an event is inadvertently not recorded in proper sequence, or was missed, the item should be flagged with an asterisk (*) at the beginning and end of the entry when it is added to the logbook, along with the time of the actual entry and the author's initials. If field logbook duties are transferred to another party, then the individuals relinquishing and receiving the logbook will both sign and date the logbook and record the transfer time.

Logbooks should not be used unless specifically required, as use of logbooks adds significantly to the efforts of scanning each page of the logbook for submittal electronically on a daily basis.

4.2 CONTRACTOR PRODUCTION REPORT

The CPR form is used when employing subcontractors, and is completed by the superintendent or field team lead. The CPR is used to record hours worked by employees and all subcontractor personnel onsite, generally by individual tradecraft. Recording of all hours worked on jobsites is required for all field personnel (Gilbane and subcontractors), and the total hours worked must be submitted to various DoD clients monthly or quarterly (per EM-385), and to Gilbane Health and Safety Department monthly. The CPR also covers construction equipment onsite and used each day and any equipment or materials that are received. A copy of the CPR is provided in Attachment A.

This form is used to track work hours performed and costs on a daily basis, because it contains a list of all personnel onsite on a daily basis, all equipment used, and all materials received. When coupled with the DAR and other appropriate forms listing other incurred costs (e.g., the number and type of samples collected, the volume and type of waste generated, etc.), the CPR provides:

- Detail to review and approve vendor invoices for subcontractor hours, materials, equipment, and waste transport and disposal.
- Near real-time monitoring of incurred costs on field projects – a necessity for some of cost-reimbursable government contracts and important on fixed-price projects to support any needed change order or request for equitable adjustment.

4.3 PHOTO DOCUMENTATION

Photographs to document "as found" or baseline conditions shall be collected. Photographs shall also be collected to document new work, changing conditions and project progress. Photo documentation should include, at a minimum, date of collection, name of photographer, directional location of photo, and brief description of the photo. An example of a Photo Log is provided in Attachment A.

4.4 FIELD CHANGE REQUEST

In the event that site conditions change or direction is received from client or regulatory agency personnel that will potentially result in changes to the scope of activities specified in the approved plans (e.g. work plan, sampling and analysis plan), the field staff must notify the Project Manager and obtain direction on what actions to take. A field change request (FCR) may be issued to document the changes or field direction for the project. The FCR form shall be completed and submitted to the Project Manager for approval and as applicable forwarded to client or regulatory agency personnel for their approvals prior to implementing changes to field work.

The directions for completing a FCR are provided in its own work instruction. Prior to using a FCR, obtain the current version of the form from the latest work instruction on g.net.

4.5 HEALTH AND SAFETY FORMS

The following forms are used to document health and safety activities on a project.

- Tailgate Safety Meeting form. This form is used to ensure all field personnel are informed of the nature of the work being performed and the safety precautions for that day. The form is provided in the site-specific Health and Safety Plan (HSP) or Accident Prevention Plan (APP).
- Equipment and Truck Inspection Checklist. This form is required for all heavy equipment used onsite, and is completed prior to or on receipt of each piece of equipment. The checklist may also be required for trucks and other motor vehicles accessing sites, to ensure compliance with site-specific requirements (i.e., presence of fire extinguisher in the vehicle, properly operating brake lights, etc.). This form is provided in the site-specific HSP or APP.
- Visitor Sign-in Log. This form is typically used for projects with extended field periods to document 3rd-party personnel onsite. This form is provided in the site-specific HSP or APP.
- Worker Acknowledgment of Site Health and Safety Requirements Form. This form is used to ensure all field personnel have read and understand the information provided in the site-specific HSP or APP.

The proper use of health and safety forms is covered by the site-specific health and safety plan (or accident prevention plan) and the forms are listed here for reference only.

4.6 QUALITY CONTROL FORMS

The Contractor Quality Control (CQC) Report serves as the basic record of the implementation and effectiveness of the QC Program. The CQC Report and any required attachments will contain the following information, as applicable:

- Inspections performed, including definable features of work and phase of control.
- Testing and/or control activities performed, with results, references to specification/drawings requirements; deficiencies found; and corrective actions implemented.
- Rework items requiring follow-up.
- Off-site surveillance/auditing activities conducted.
- Instructions given and received, and identified conflicts in plans and/or specifications.
- QC Manager's verification statement.

The QCM may include as attachments to the CQC Report any of the following:

- Three-phase checklists, including preparatory meetings, initial inspections, follow-up or ongoing inspections;
- Subcontractors' Daily Logs
- Material Receipt Inspection Reports
- Punch list
- Any test results and other pertinent logs or receipts,

Additional requirements will be outlined in the Construction Quality Control Plan (CQCP). The proper use of quality forms is covered by the site-specific CQCP and the forms are listed here for reference only.

4.7 PROJECT SPECIFIC FORMS

The following forms are examples of project specific forms that may be needed for some contracts or to document specific field activities:

- Field activity-specific forms - Various forms used to document specific field activities at environmental sites provided with their respective SOPs and the site-specific SAP. These can include, but are not limited to, the following:
    - Monitoring Well Water Level Measurement Forms
    - Instrument Calibration Records
    - Monitoring Well and Sample Forms
    - Sample Collection Logs
    - Sample Tracking Log
    - Soil Boring Log
    - Chains-of-Custody

Field personnel shall use these forms (and any other forms identified in the site-specific plans or by project management on a project- or task-specific basis), in addition to the DAR and CPR as described in Section 4.1 and Section 4.2, respectively, to assure that all activities are properly and fully documented <u>at the time the work is performed</u>.

4.8 FEDERAL, STATE, AND LOCAL AGENCY FORMS

Any forms required by federal, state, and/or local agencies (e.g. site access, hot work permits, Uniform Hazardous Waste Manifests, local drilling and well construction/abandonment permits, etc.) shall be completed and submitted in accordance with current federal, state, and local guidance requirements and regulations.

5.0 FIELD RECORDS MANAGEMENT

Field records management includes record completion, review, approval and document submittal. All records associated with the field activities shall be managed by the designated responsible party (e.g. FTL, Task Manager, Site Supervisor, QCM, site health and safety officer, or onsite Project Manager). The responsible party is responsible for the completion of the records, review, corrections and approvals. Any corrections made shall be made as described in Section 4.0.

5.1 DAILY FIELD DOCUMENTATION PACKAGES

All field forms documenting one day's activities after they are reviewed and approved are collected and submitted to the project point of contact (typically the QCM) and packaged together as one submittal. The original documents are initially kept together as a daily package for scanning and submittal to project files and to the client (per contract requirements).

A hard copy of the complete daily package must be kept on site for client or third party auditors, unless otherwise stipulated by the contract. If records are uploaded daily to eDMS, and web access is available from the site, then hard copy records for only the current field effort may be allowed with approval of the PM, PgM, and QCM. The originals are then placed in individual hard copy files. Project electronic files should include the complete daily package and individual files of the records included in the daily package (e.g. DAR, CPR, Tailgate Safety Meeting, SLC, chain of custody).

5.2 RECORD SUBMITTAL

Completed records shall be submitted by the QCM (or whoever is collecting and consolidating the daily records package) to the project files and to the client. The daily field documentation package should be uploaded to the project files at the end of each day, or no later than the morning of the following work day. Typically the daily package is also due to the client no later than 10:00 am the following business day.

Internally, Gilbane shall, at a minimum, submit project files to eDMS or DMS as appropriate based on project type:

- eDMS[1] for most all environmental projects and for field efforts involving the collection of environmental data (whether physical samples for fixed or mobile laboratory analysis, data collected from instrumentation in the field, or field observations of an environmental nature) supporting construction or fuels projects.
- DMS for field projects supporting construction or fuels, and not involving the collection of environmental data and with no required program or client portals.

Additional external submittal requirements will vary based on contract specifications. For example, there are program or client required portals (e.g., EPA, NAVFAC or USACE) for uploading field documentation and reports.

Daily uploading of the daily field documentation packages is critical for any project generating analytical data to allow for timely coordination between the sample crew, the project chemist, and the analytical laboratory. For projects that <u>are not generating analytical data</u>, uploading the

1 Instructions on both uploading and approving daily field documentation packages are provided in Attachment B. Directly uploading to eDMS has the advantage of being web-based and does not require logging into the VPN network, required when uploading the daily field documentation packages to project servers.

daily field documentation packages no later than the end of each week may be acceptable, with concurrence from the PM, PgM and QCM.

6.0 ATTACHMENTS/FORMS

6.1 ATTACHMENTS

Copies of the following documents are attached.

- Attachment A - Instructions on Uploading and Approving Documents in eDMS, and naming convention for uploaded documents.

6.2 FORMS

Copies of the following forms are attached. Additional approved activity-specific forms such as those identified above are provided with their respective SOPs, in project specific plans, or by the client.

- Daily Activity Report (DAR)
- Contractor Production Report (CPR)
- Photo Log

7.0 REFERENCES

Department of the Navy, Naval Facilities Engineering Command, 2000. *Construction Quality Management Program*, NAVFAC P-445, NAVFAC 0525-LP-037-7202, January.

Los Alamos National Laboratory, 2010. *SOP-5181 Environmental Programs Waste and Environmental Services for Notebook and Logbook Documentation for Environmental Directorate Technical and Field Activities.* 2010.

U.S. Army Corporation of Engineers, 2008. Manual, *Safety and Health Requirements*, EM-385-1-1, September.

U.S. Environmental Protection Agency (USEPA) Region 4, 2007. *Operating Procedure for Logbooks,* SESDPROC-010-R3. November.

USEPA, 2011. *Contract Laboratory Program Guidance for Field Samplers,* Office of Superfund Remediation and Technology Innovation, OSWER 9240.0-47, EPA 540-R-09-03. January.

Forms

- Contractor Production Report
- Daily Activity Report
- Photo Log

Contractor Production Report

(Attach Additional Sheets if Necessary)

Gilbane

Project Name:	Page of
Project No./Task Code:	Date:
Subcontractors:	

Work Performed Today

Schedule Activity No.	Work Location and Description	Employer	Number	Trade	Hours

Job Safety

Was a tailgate safety meeting held this date? (If yes, attach copy of the sign-in sheet)	☐ YES	☐ NO	Total Work Hours on Job Site Today (including any Continuation Sheets)	
Were any vehicle/heavy equipment inspections done? (If yes, attach copies of the inspections performed)	☐ YES	☐ NO	Cumulative Total of Work Hours from Previous Reports	
Was any trenching/confined space/crane/manlift work done? (If yes, attach statement or checklist showing inspections performed)	☐ YES	☐ NO	Total Work Hours from Start of Field Activity	
Were there any lost time accidents this date? (If yes, attach copy of completed accident report)	☐ YES	☐ NO		

Schedule Activity No.	List Safety Actions Taken Today/Safety Inspections Conducted ☐ Safety Requirements Have Been Met.

Equipment/Material Received Today To Be Incorporated In Job (Indicate Schedule Activity Number)

Schedule Activity No.	Submittal #	Description of Equipment/Material Received

Construction And Plant Equipment On Job Site Today (Indicate Hours Used And Schedule Activity Number)

Schedule Activity No.	Owner	Description of Construction Equipment Used Today (include Make and Model)	Hours Used

Schedule Activity No.	Remarks

Prepared by:	Signature:

Daily Activity Report (DAR)

Gilbane

Project Name:	Page of
Project No./Task Code:	Date:
Description of Work:	
Visitors / Subcontractors:	
Weather:	

Description of Field Activities

Prepared by:	Signature:

Photographic Log	Gilbane
Project Name:	Page of
Project No./Task Code:	Date:

Daily Photographs

Size photographs to 2" by 3"	
Photo 1: Photo caption	Photo 2: Photo caption
Photo 3: Photo caption	Photo 4: Photo caption
Photo 5: Photo caption	Photo 6: Photo caption

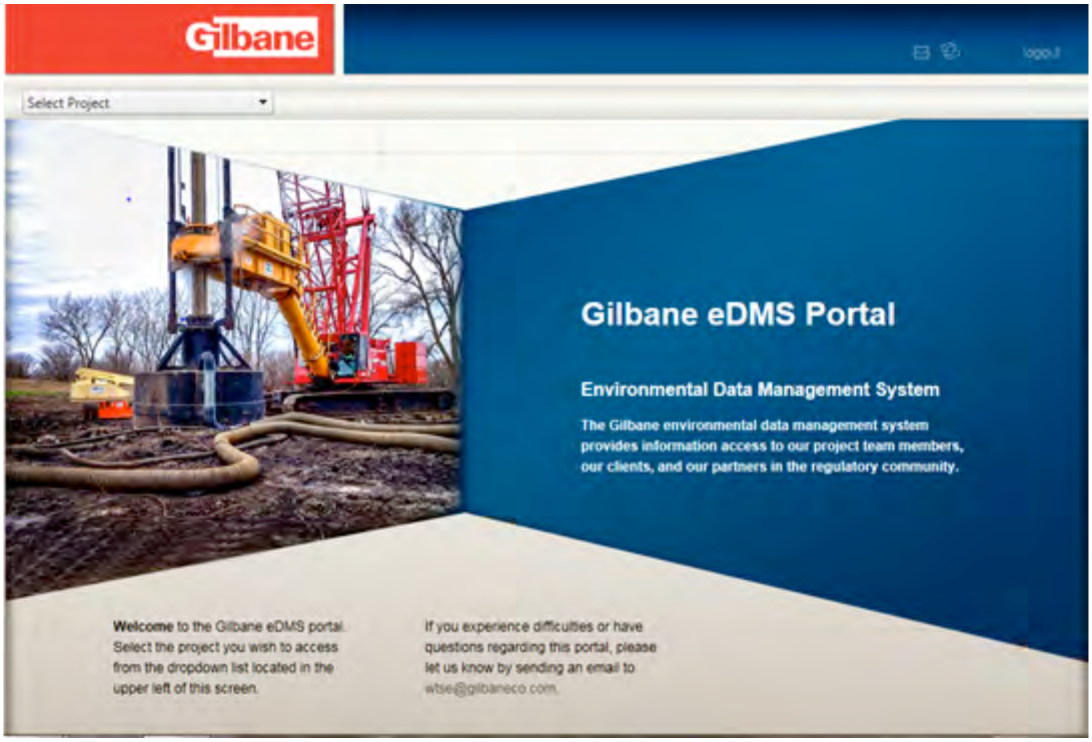
Attachment A

Instructions on Uploading and Approving Documents in eDMS:

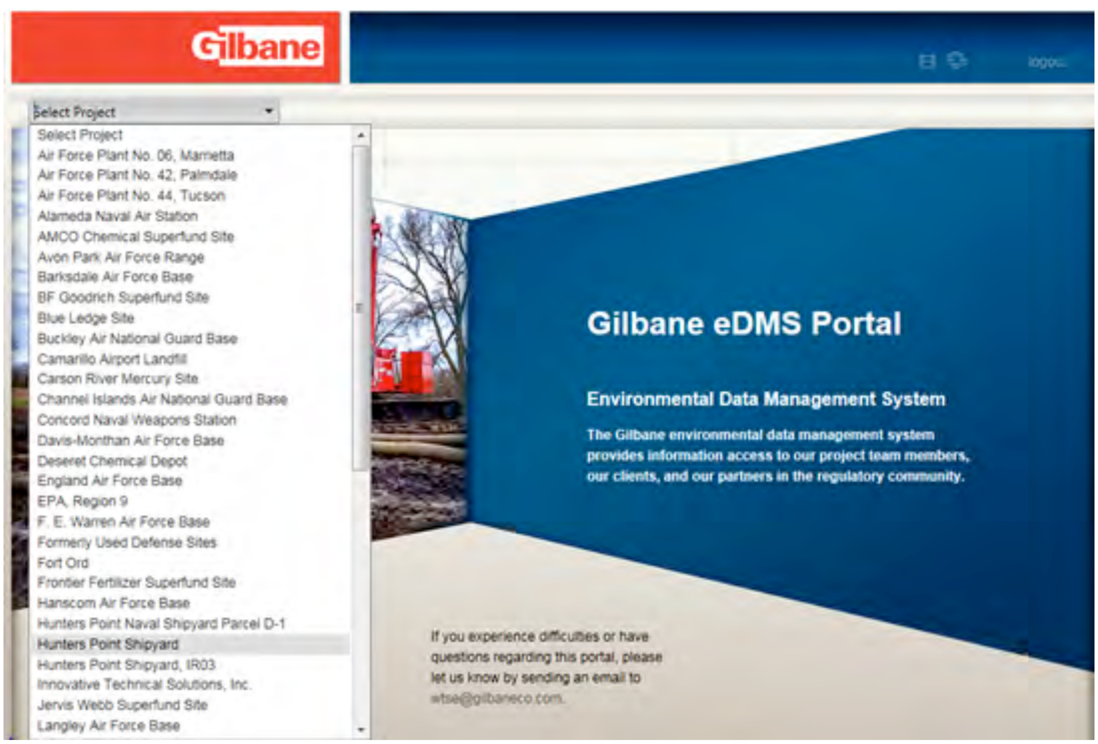
- Uploading Documents in eDMS
- Approving Documents in eDMS
- File Naming Convention

Instructions
Uploading Documents in eDMS

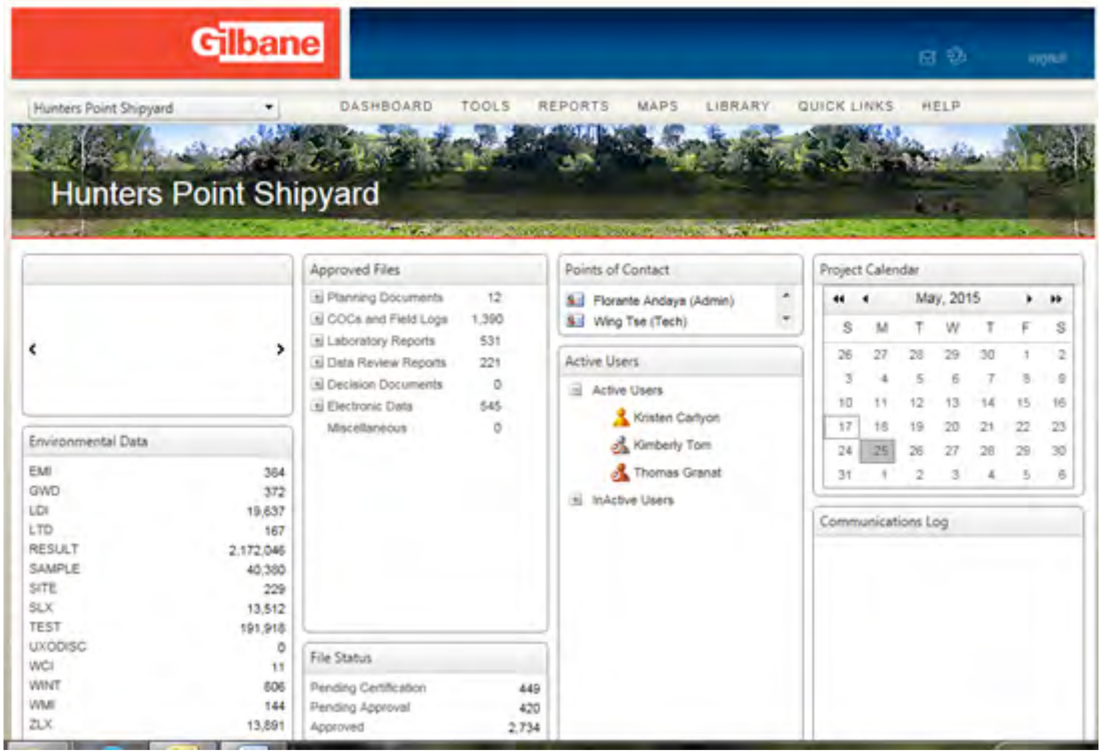
Open your browser, and go to http://edms.itsi.com



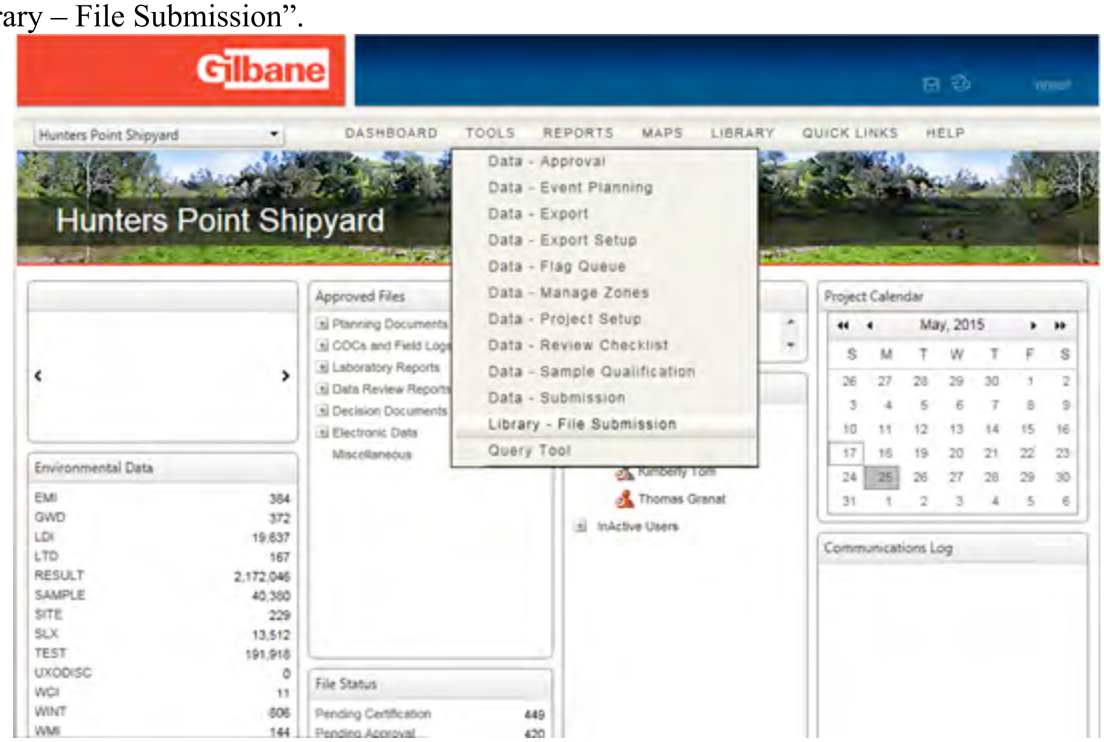
Select your project from the pull-down menu. Note, each person's list of projects will vary, as only those projects you have permissions for are shown.



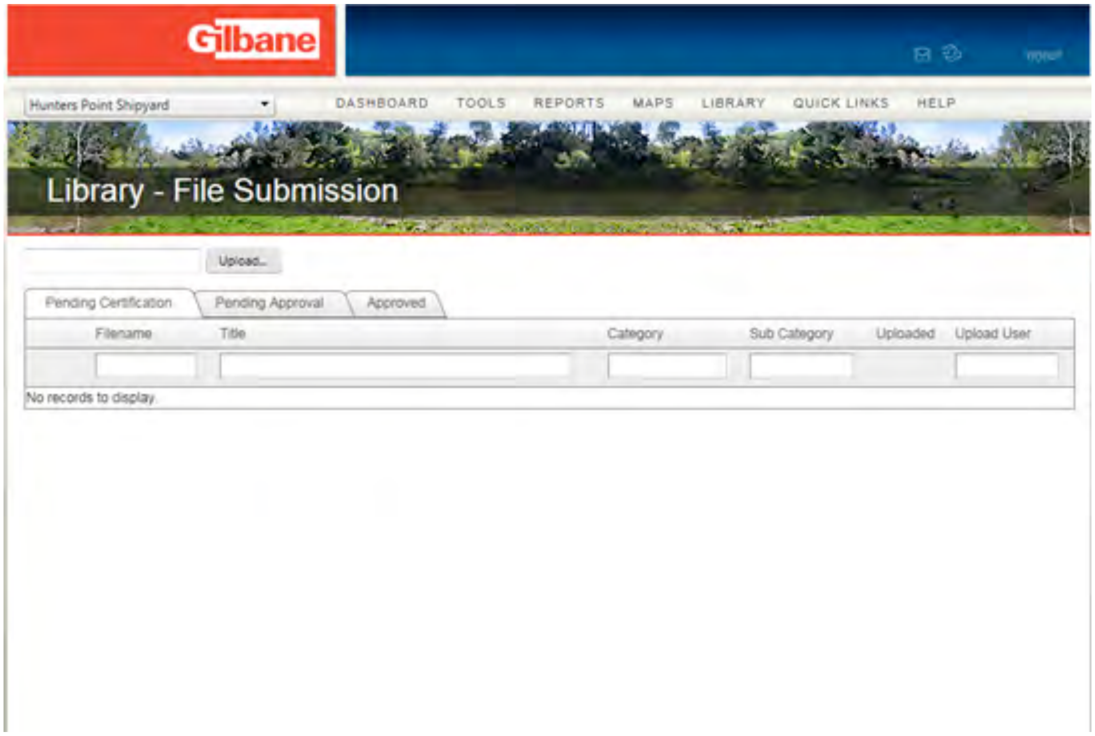
The screenshot below is of the “dashboard” for the Hunters Point project database under eDMS, as an example. The dashboard shows the status of various submittals, points of contact and project calendar.



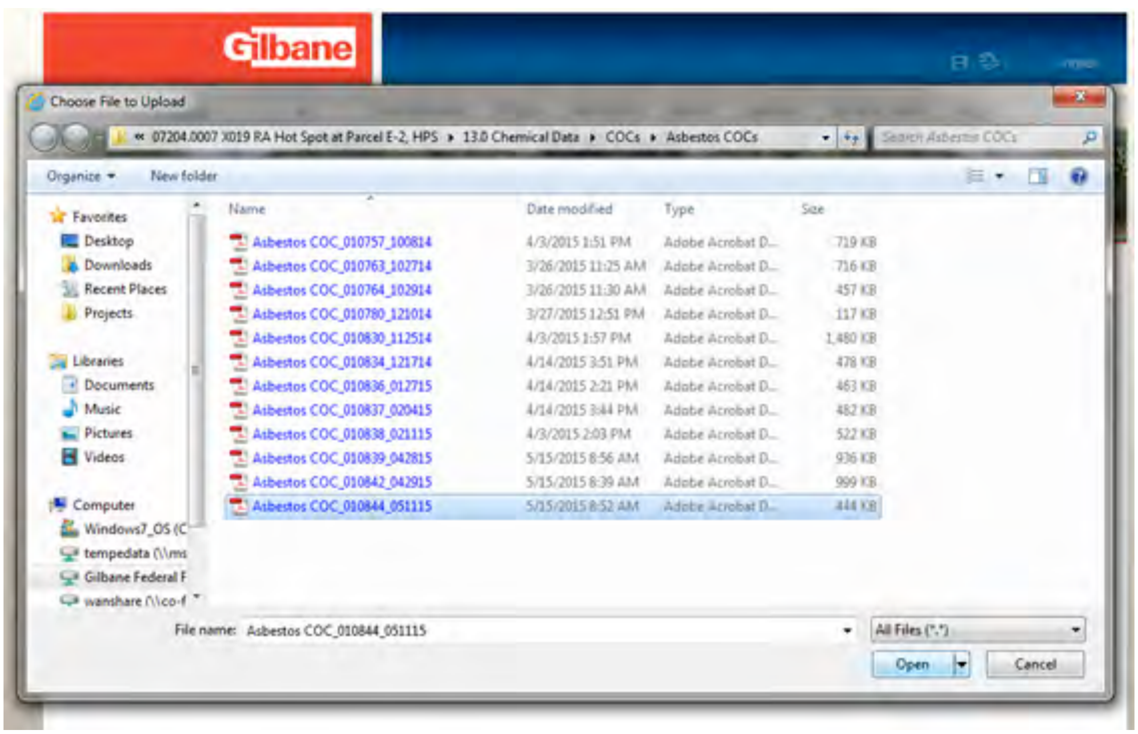
To upload documents to the library in the project database, click on the “Tools” menu and select “Library – File Submission”.



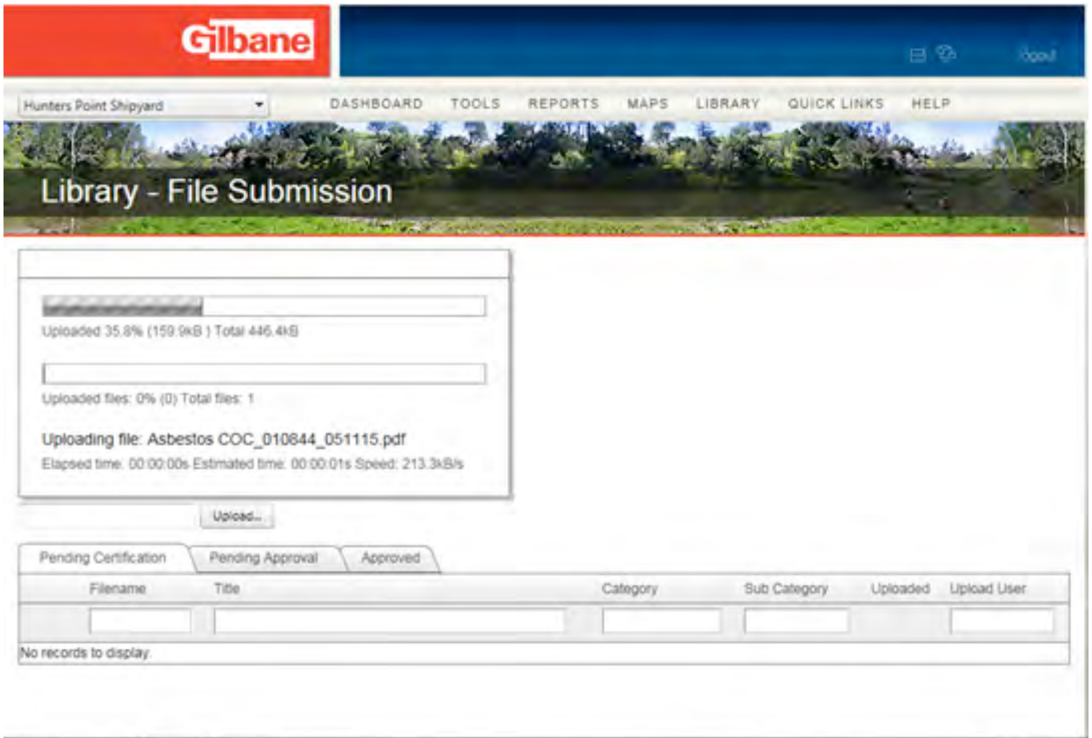
Select “Upload” and you will be directed to a separate screen from which you can browse to the desired file.



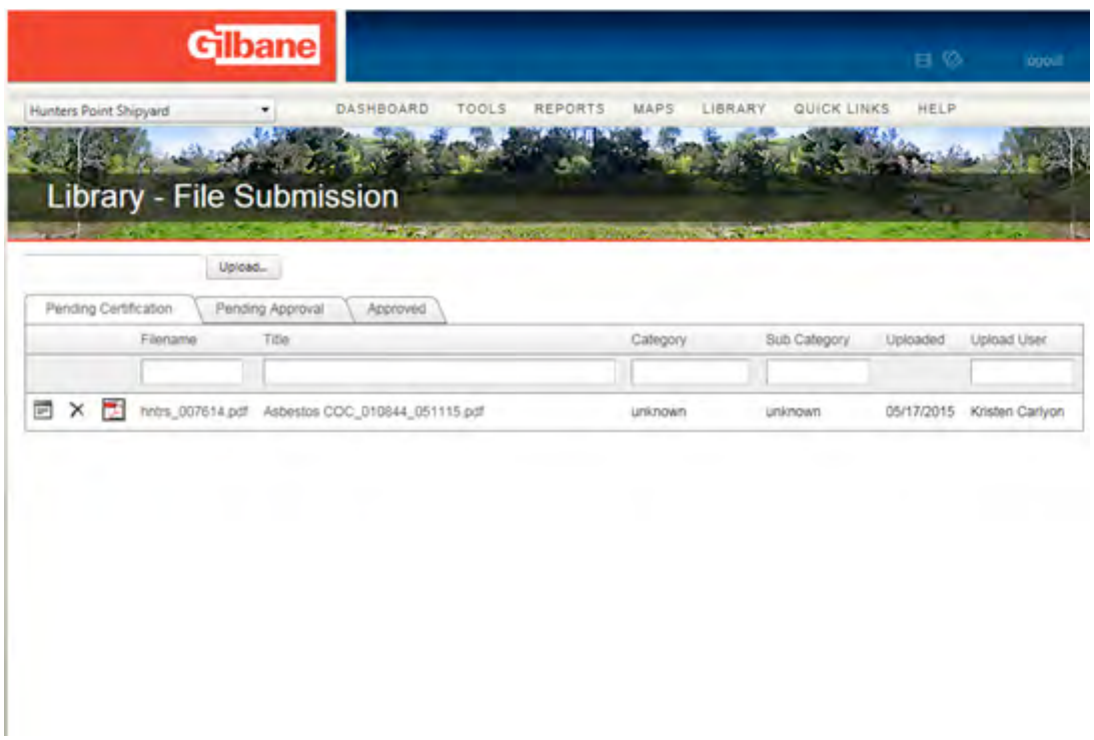
One file at a time may be uploaded , with a 200 MB maximum upload.



Click on the “Open” button to upload from your computer. The upload process is then displayed.



The file is then listed in the "Pending Certification" screen. See below for further description.



Files have three states:

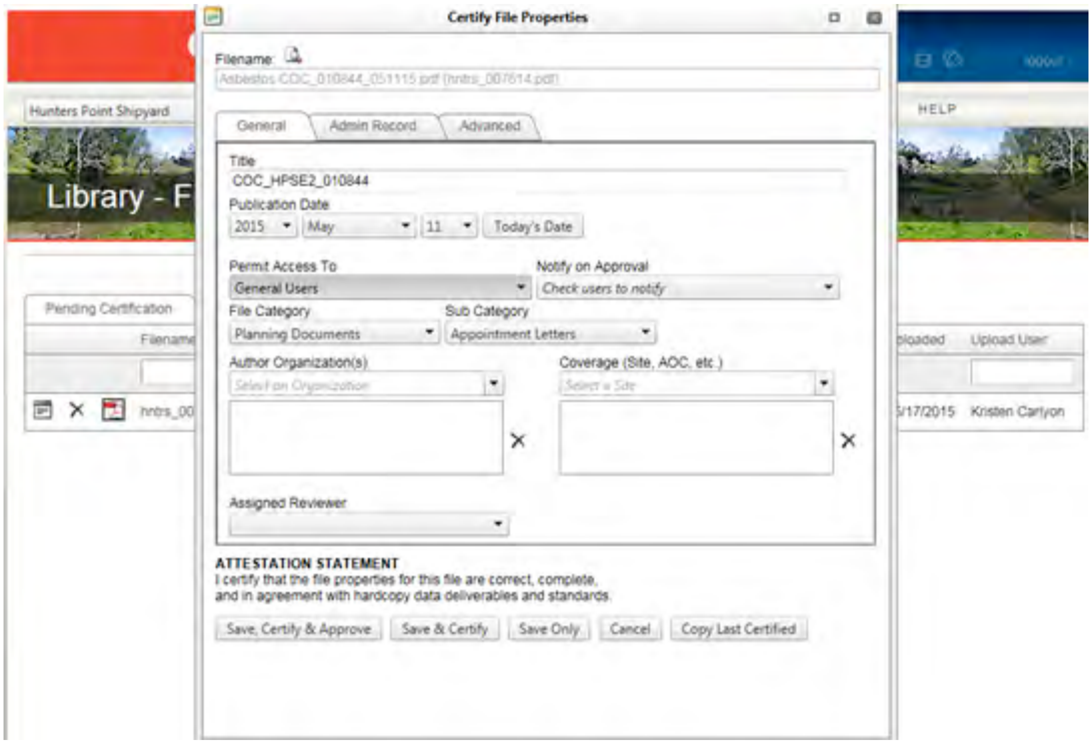
1) **Uncertified (Pending Certification)**. Uncertified files represent the initial uploaded document without completed metadata.
2) **Certified (Pending Approval)**. The file is complete from the perspective of the person uploading the file. The document and associated metadata is ready for QC, and is visible only to those parties with approval authority in the library submission module.
3) **Approved**. The document and associated metadata is complete and accurate, represents information collected consistent with the planning documents and other requirements of the project, and was successfully QC'ed by a second person. The "approved" document is now transferred to the general library and is viewable by all parties who have appropriate access to the project database.

Since the above document is still "Uncertified", the file upload process is not yet complete until additional information (the metadata) is input relative to the file, and the file is "certified" by the submitter.

To edit the metadata (source data) associated with the uploaded file, click on the far left box with the check mark and enter the appropriate information on the resulting "Certify File Properties" screen. This information includes (at a minimum):

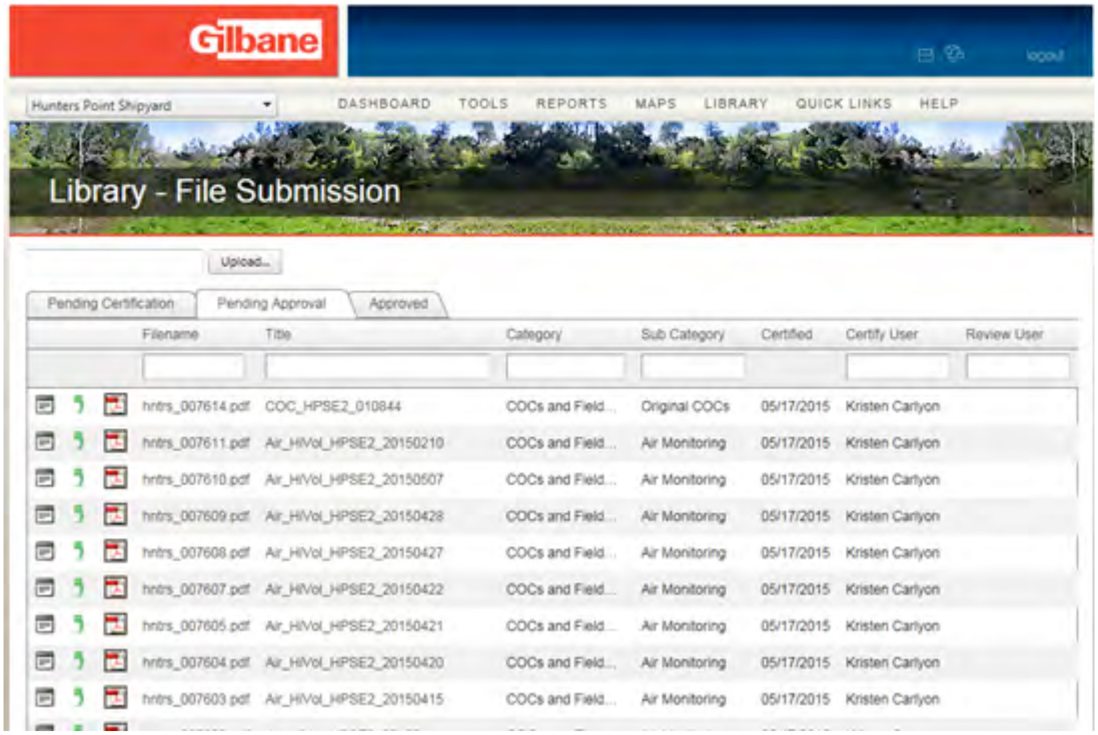
- Title of the document (this is the name the document will have in the project library, so keep this consistent for the same type of document using the eDMS filing conventions in Attachment 1),
- Date of the document (or date the field or meeting notes represent)
- Permit access to (who can access the document, typically this is "general users" but the system does allow for the storage of confidential information available only to a select category of user)
- Document "file category" and "sub category" (these are important, as specific searches can be performed by sub category of document, such as requesting all chain-of-custodies on the project to date)
- Author organization (typically Gilbane for our reports, memorandums, field notes etc.)

An example of a completed certification screen is below:



Once the metadata is completely entered (at least the minimum set of information as identified above), click the "Save and Certify" button.

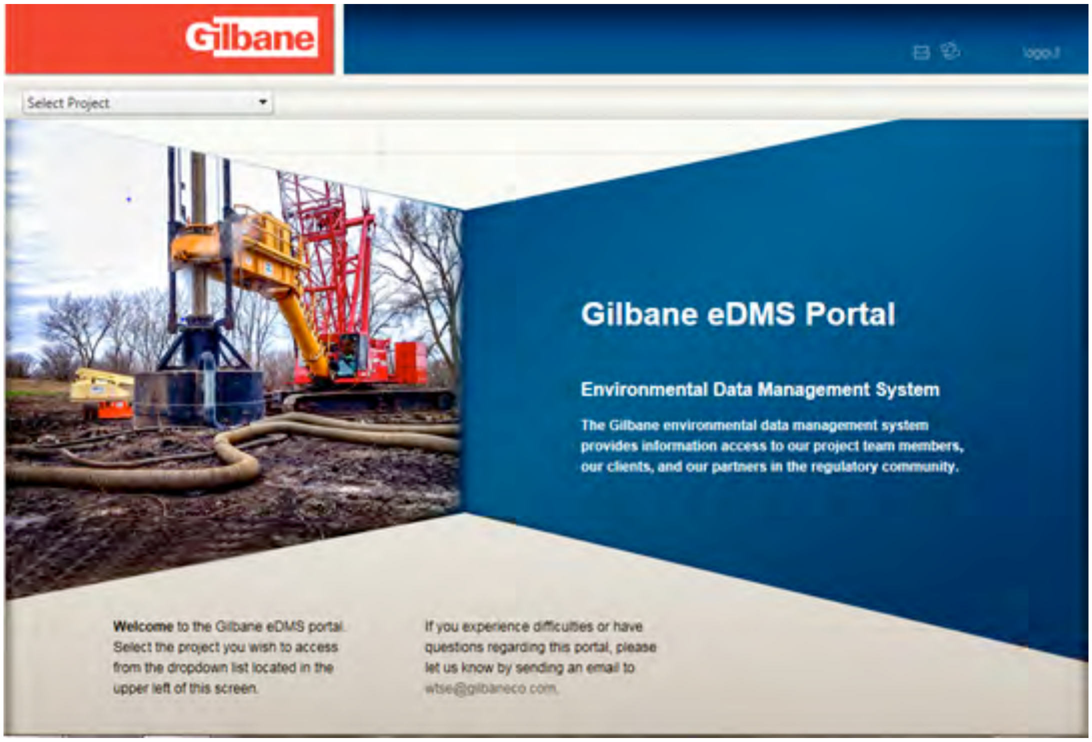
To verify the document has been saved and certified, navigate to the “Pending Approval” screen. The document should now appear under this list.



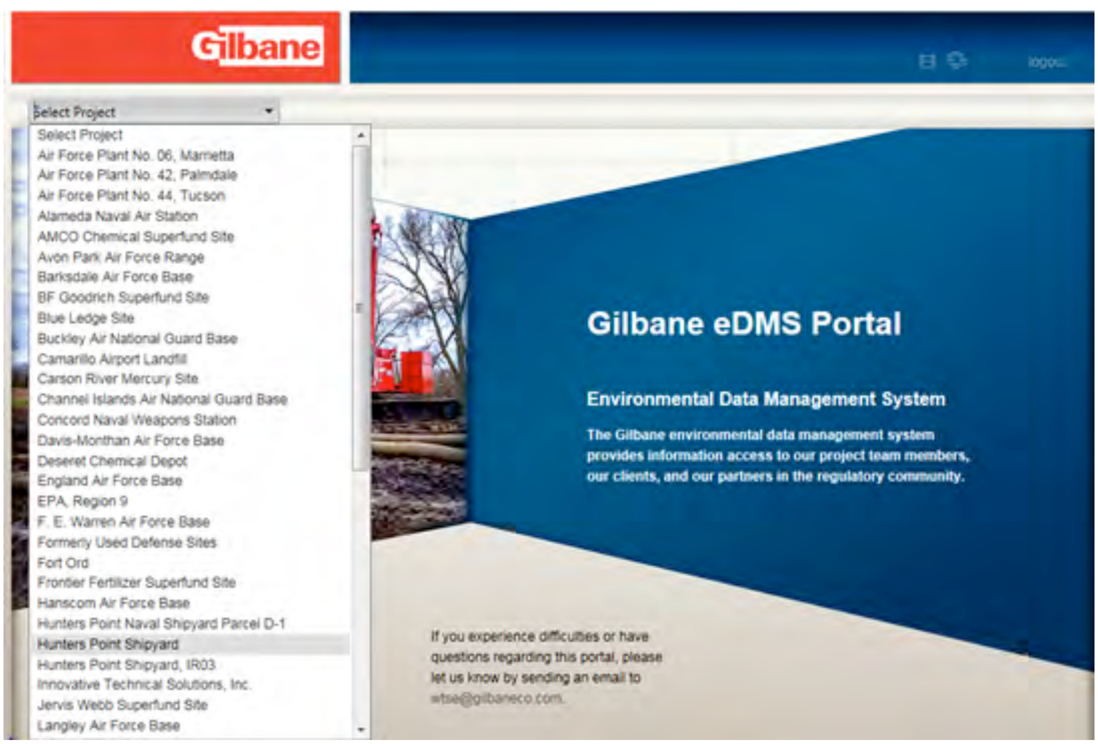
The document has now successfully been uploaded to the project library. However, at this step the document is only available to those who have library approval rights to the database, not general users. To make the document available to all users, the document must be QC checked and “approved”. Separate instructions are provided for the approval process.

Instructions
Approving Documents in eDMS

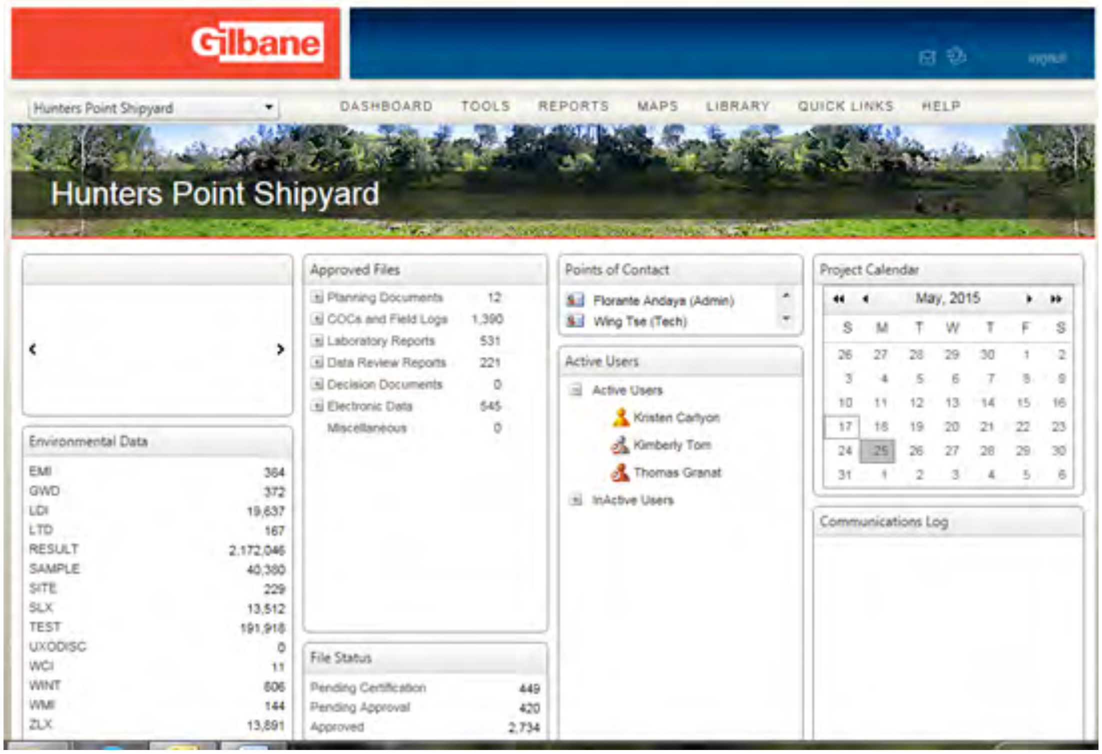
Open your browser, and go to http://edms.itsi.com



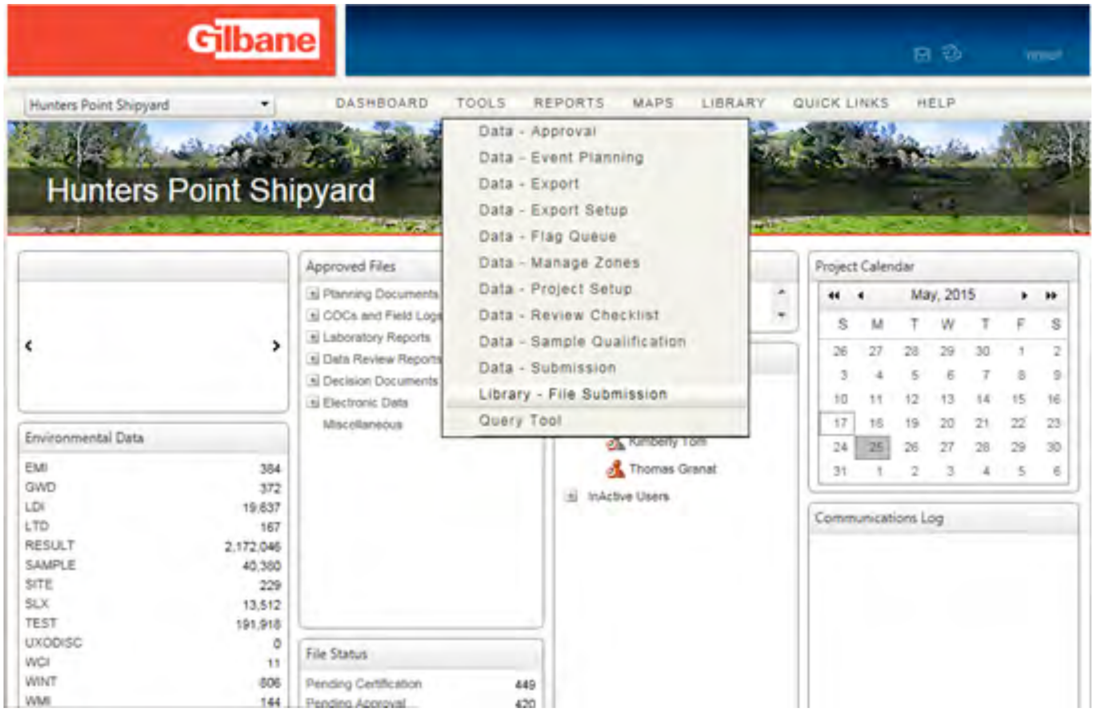
Select your project from the pull-down menu. Note, each person's list of projects will vary, as only those projects you have permissions for are shown.



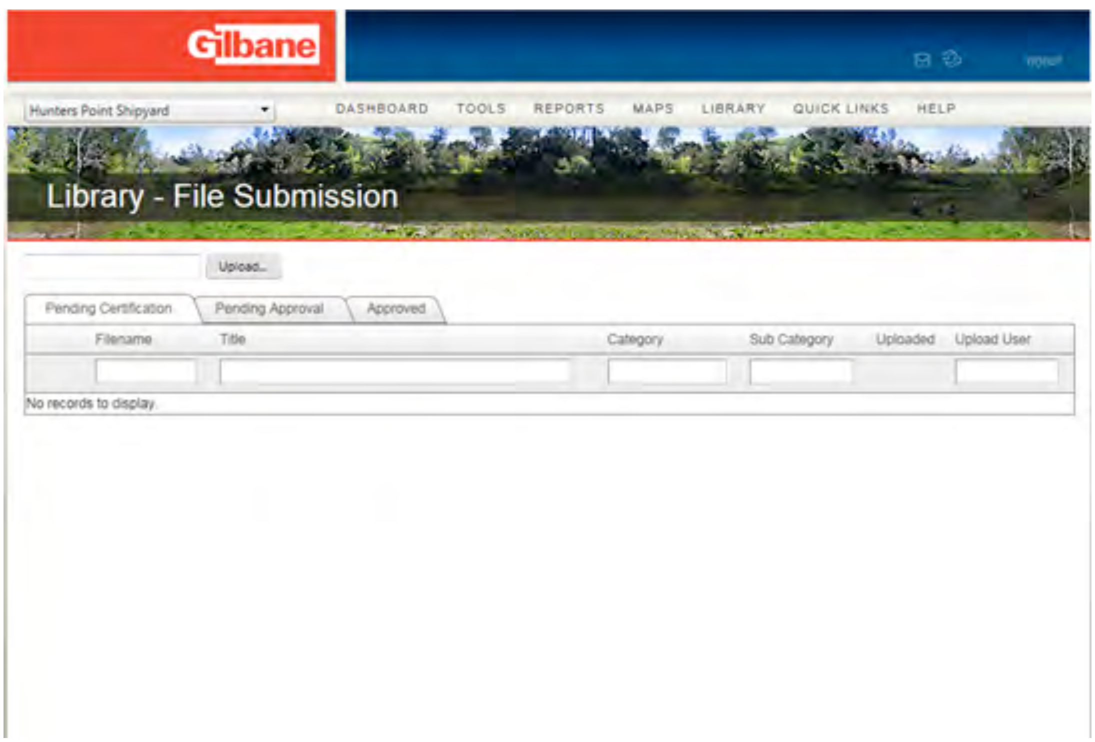
The screenshot below is of the “dashboard” for the Frontier Fertilizer project database under eDMS, as an example. The dashboard shows the status of various submittals, points of contact, project calendar, and displays recent photos uploaded to the project database.



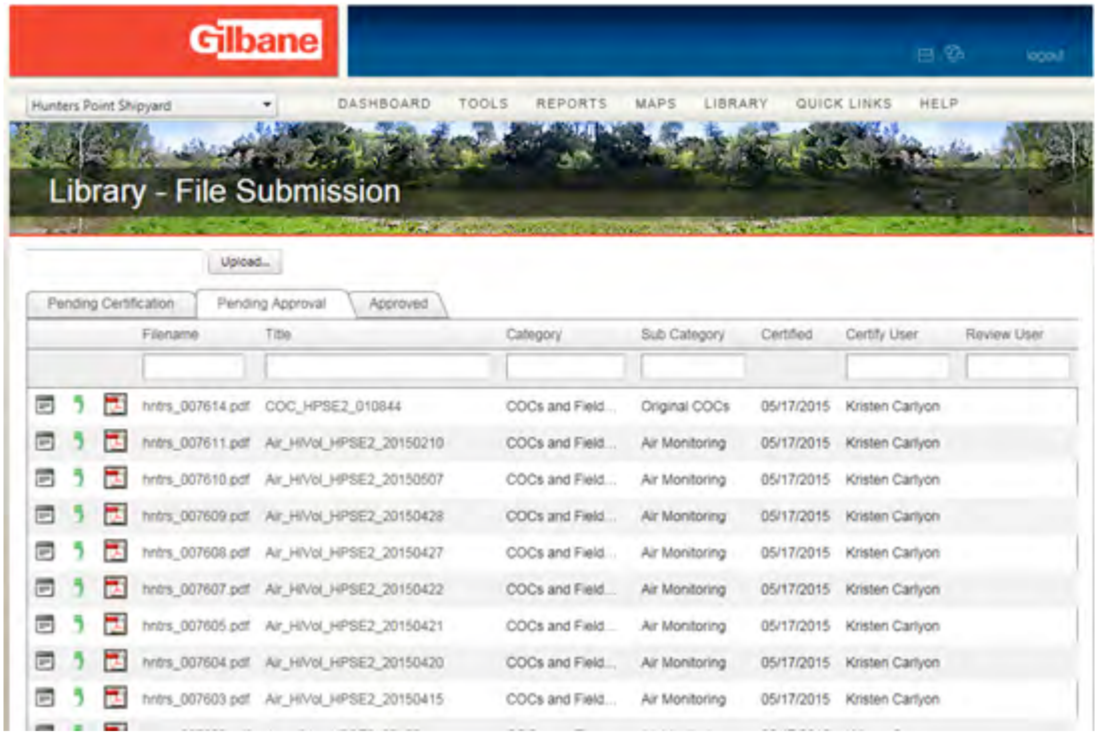
To QC and approve a document in the library in the project database, click on the "Tools" menu and select "Library – File Submission".



Select the "Pending Approval" tab from the library main menu.



A list of documents will be displayed:



To review the file for approval:

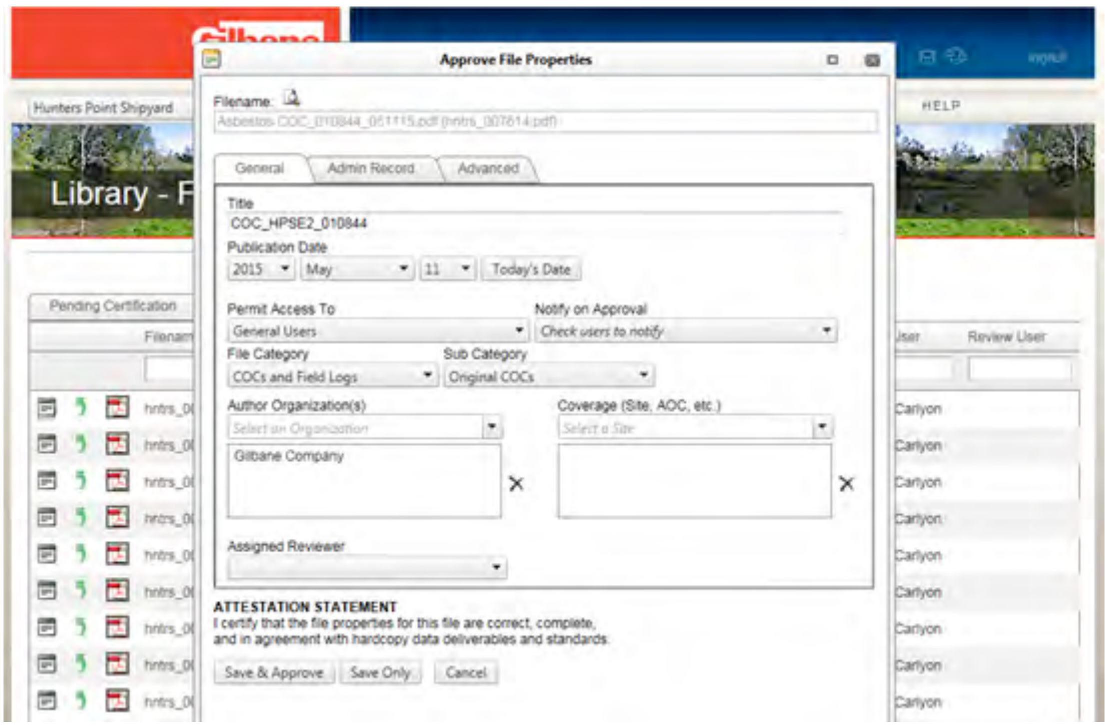
Click on the PDF icon. This pulls the document up in a separate window to verify that the contents of the PDF match the title of the file.

1. If there are problems with the document and it needs to be corrected or amended by the submitter, click on the box containing the green back arrow and "uncertify" the document. This will return it to "uncertified" status and allow for the document to be replaced with a corrected version by the original submitter. The reviewer will then need to notify the original submitter regarding the necessary corrections and that the document will need to be re-uploaded once corrected.
2. If the document is ok, then click on the far left box. This pulls up the metadata (source data) associated with the document. Please verify the information is correct and make any changes needed to the metadata to complete the minimum required information and make it consistent with previous entries. The minimum needed metadata includes:
    a. Title of the document (this is the name the document will have in the project library, so keep this consistent for the same type of document using the eDMS filing conventions in Attachment 1),
    b. Date of the document (or date the field or meeting notes represent)
    c. Permit access to (who can access the document, typically this is "general users" but the system does allow for the storage of confidential information available only to a select category of user)

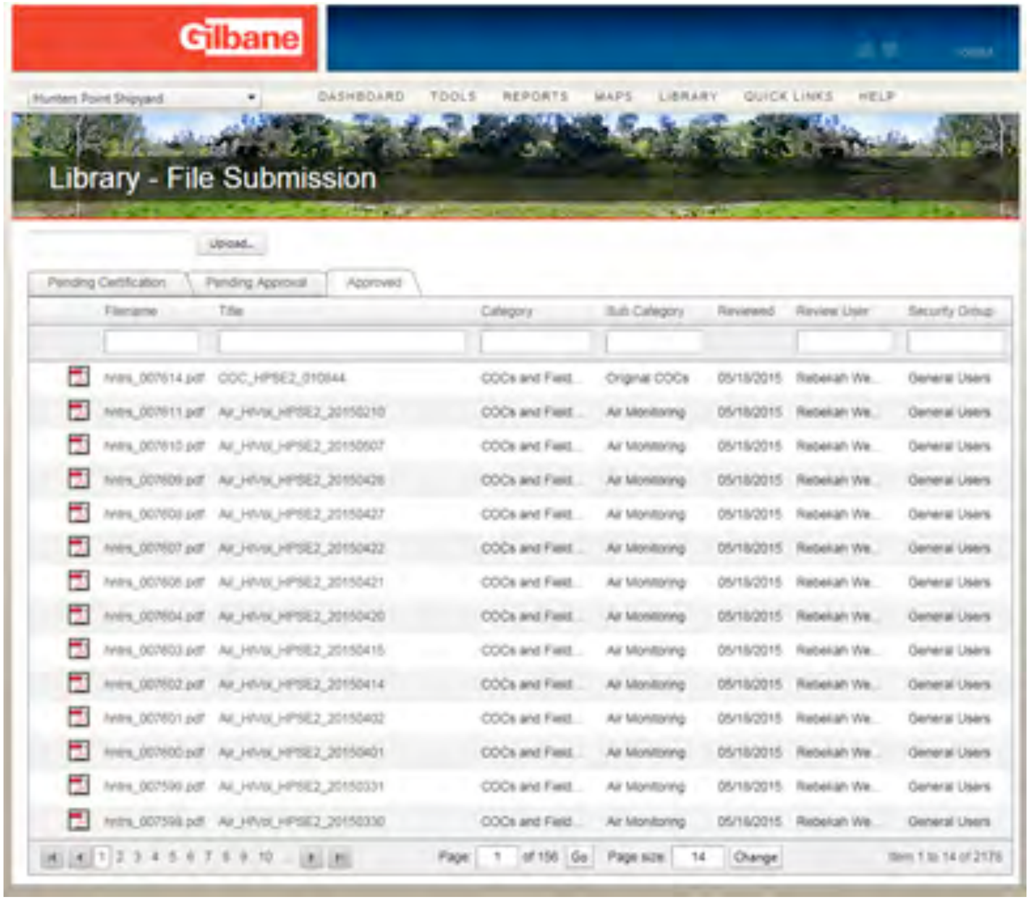
d. Document “file category” and “sub category” (these are important, as specific searches can be performed by sub category of document, such as requesting all chain-of-custodies on the project to date)

e. Author organization (typically Gilbane for our reports, memorandums, field notes etc.)

3. Once the metadata has been verified, click the “Save and Approve” button.



To verify the document has been saved and approved, select "Approved" from the pull down menu ("File Status"). The document will now appear in the list under "Approved".



The document has now successfully been approved for full access in the project library and is available to all users who possess the minimum permissions established for the document.

eDMS Filing Convention

File Type	Library Category	Library Subcategory	File Naming Convention
RSOR Appointment Letter	Planning Documents	Appointment Letters	RSOR_TMock
QCM Appointment Letter	Planning Documents	Appointment Letters	QCM_BWomack
Chain-of-Custody Sample Collection Log Air Monitoring Log Weather Data	Field Documents Field Documents Field Documents Field Documents	COCs and SCLs COCs and SCLs COCs and SCLs COCs and SCLs	COC_XXXXXX where XXXXX represents the COC alphanumeric ID SCL_20131009 Air_20131009 Weather_20131009
Daily Activity Reports	Field Documents	DARs and CPRs	DAR_20131009
Daily Production Report	Field Documents	DARs and CPRs	CPR_20131009
Contractor Quality Control Report 3-phase Inspection Reports – Combined Form – Preparatory Form – Initial Inspection Form Material Receipt Inspection Checklist Other QC-related forms as needed	Field Documents	Contractor Quality Control Reports	CQCR_20131009 Bundled in above file (Ideally) “ “ “ “ “
Tailgate Meetings Equipment Inspections – Initial (R-150) – Daily – Weekly	Field Documents	Health and Safety Reports	Safety_20131009
Radiological Safety – related Items – Rad Work Access Log – TLD Issue Form – TLD Issue Log	Field Documents	Health and Safety Reports	RadSafety_20131009 Bundled in above file “ “
Photo Logs	Field Documents	Photo Logs	PhotoLog_20131009
Rad Surveys	Field Documents	Radiological Survey Reports	RadSurvey_20131009

File Type	Library Category	Library Subcategory	File Naming Convention
Biological Monitoring	Field Documents	Biological Monitoring	BioMon_20131009

Notes:

1. For databases with multiple projects, the filing convention should contain a project designator after the initial code. For example, the hunters point database convention would be:
   - SCL_HPSE2_20151012
   - AIR_HPSC_20140914
2. Categories can vary slightly from database to database depending on age. Newer databases are more consistent. For example, the category "COCs and SCLs" is equivalent to "Original COCs" in the Hunters Point Shipyard database.

Standard Operating Procedure

Surface Soil: Sampling with Trowel or Spoon

PR-TC-02.02.01.01 v2.1a

Reviewed by: Clare Gilmore — Date: 14 June 2013
Clare Gilmore, Senior Geologist

Reviewed by: Jim C. Schollard — Date: 14 June 2013
Jim Schollard, Program QA/QC Manager

Approved by: Jeffrey Hess — Date: 14 June 2013
Jeffrey Hess, Director Technical Services

Review / Revision History:

Version	Changes	Affects Section/Pages	Effective Date	Approval*
1.0	Initial Issue		1 Oct 2009	NA
2.0	Add provisions to retain weathered soil for non-VOC analysis, and option for placement of sample material directly into appropriate sample containers.	Pages 2-4	14 Jun 2013	NA
2.1	Updated organization name. No other changes needed.	All	6 Aug 2014	J. Hess
2.1a	Reviewed. No changes needed.	–	14 Oct 2016	JHA

* Approval required for reviews and minor changes only. Substantive revisions to the technical requirements contained in the SOP require review and approval by the signatures to the SOP.

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Table of Contents

1.0 PURPOSE AND SCOPE

The purpose of this standard operating procedure is to describe the methods and procedure for sampling of surface soils using trowels or spoons (scoops). Trowels or spoons can be used when soil matrices are composed of relatively soft and non-cemented formations, and to depths of up to 12 inches into the ground surface, depending on site conditions.

Note: Samples for VOC analysis should not be collected via trowel or spoon method. However, a trowel or spoon may be used to penetrate and expose the undisturbed material to the desired depth for sampling using an approved VOC sampling device.

1.1 LIMITATIONS

Samples from depths greater than 12 inches below the surface, or in matrices that are difficult to penetrate using a spoon or a trowel, should be collected using an alternative method (see SOP PR-TC-02.02.01.02, Surface Soils: Drive Sampler, Hand Auger or Test Pit, and SOP PR-TC-02.02.01.03, Subsurface Soils: Direct Push or Drill Rig.)

2.0 ACRONYMS AND DEFINITIONS

For purposes of this procedure, a number of terms and acronyms have the meanings defined below.

COC: **chain-of-custody form**

DAR: **Daily Activity Report**

GPS: **global positioning system**

HSP: **Health and Safety Plan**

PPE: **Personal protective equipment**

SCL: **Sample Collection Log**

Scoop. Used interchangeably with "spoon." A sample collection device with a round metal blade attached to a handle.

SOP: **Standard Operating Procedure**

Spoon. Used interchangeably with "scoop." A sample collection device with a round metal blade attached to a handle.

Surface Soil. Soil that is removed from the surface (i.e., from a depth no greater than 12 inches below grade after vegetation, rocks, etc. have been cleared.

Trowel. A sample collection device with a curved and pointed metal blade attached to a handle. All trace environmental samples should be collected using stainless steel blades or single-use disposable plastic trowels.

VOC: **volatile organic compound**

3.0 PROCEDURES

The intent of these procedures is to identify the steps to be taken to assure that surface soil samples are collected efficiently and that the samples accurately reflect current conditions for the location and matrix from which they are collected.

3.1 SAMPLE COLLECTION

The following steps should be followed to collect samples of surface soil by hand using a trowel or spoon (NOTE: the words "trowel" and "spoon" are used interchangeably in the following text):

1. Don a pair of clean sampling gloves (e.g., Latex, Nitrile).
2. If desired, place plastic sheeting around the targeted location to keep sampled material in place. Use a knife or scissors to cut an access hole for the sample location.
3. If a larger volume of soil will be collected than necessary to fill the appropriate sample containers (due to heterogeneity of the soil at the sample location), place a clean stainless steel bowl large enough to hold the soil to be collected within reach of the sample location.
4. Remove any surficial debris (e.g., vegetation, rocks, etc.) from the sample location and surrounding area until the soil is exposed. Once exposed, the soil surface is designated as "at grade" or 0 inches.
5. If collecting a sample for volatile organic compounds (VOCs), use a trowel or spoon to scrape and remove the top 1/8 to 1/4 inch of weathered soil[1], if present. Otherwise, retain the material as part of the sample.
6. Collect all samples for VOC analysis first using an approved VOC sampling device.
7. Using a new/clean (i.e., disposable or decontaminated) trowel, place the point of the blade on the ground. While holding the handle of the trowel, partially rotate the blade in a clockwise/counter-clockwise motion while pushing downward at an angle until the blade is inserted to the required depth or the blade is nearly covered. Be certain that the trowel is not inserted to a depth where the soil will touch the handle or the sampler's gloved hand.
8. With a prying motion, lift up the trowel with soil on the blade and place soil directly into the appropriate sample container(s) specified in the approved project plans or as provided by the analytical laboratory, or into the stainless steel mixing bowl.
9. Repeat steps 6 and 7 until the specified sampling depth is reached and the required amount of soil has been collected.
10. Measure the depth below grade of the sample location with an Engineer's Rule or measuring tape to verify the sampling depth, obtain the GPS coordinates of the

[1] Weathered soil is often the top 1/8 to 1/4 inch of soil that can be affected by factors such as heat from the sun, rain, and/or foot or vehicular traffic that can result in loss of VOCs present in the shallow soil.

sample location, and record the depth/interval and GPS coordinates on the Sample Collection Log (SCL) or in the Daily Activity Report (DAR), as appropriate.

11. When using a stainless steel mixing bowl, homogenize the non-volatile organic compound (VOC) sample media first as specified in the approved project plans, then transfer the sample directly into the appropriate sample container(s) specified in the approved project plans or as provided by the analytical laboratory.
12. If using a wide-mouth glass jar, seal the jar with a Teflon-lined cap. If using a stainless steel sample tube, cap both ends of the tube with plastic caps lined with Teflon sheets.
13. Clean off the surface of the sample container; complete the sample label and chain-of-custody (COC) documentation; attach the label to the jar or tube; place the sample containers in Ziplock® Freezer Bag or equivalent and place the sample into a sample cooler maintained at 4 degrees Celsius.

3.2 EQUIPMENT

The following equipment should be used when collecting samples with a spoon or trowel:

- Decontaminated stainless steel or new disposable trowel or spoon.
- Engineer's Rule or stiff measuring tape.
- Decontaminated stainless steel mixing bowl.
- Sample container(s) as specified in the approved project plans.
- Sample collection supplies (e.g., caps, sample labels, coolers, ice, etc.).
- Plastic sheeting.
- DAR (or field logbook, when required) and SCLs for recording field notes and sample locations as specified in this SOP and/or in the project plans.
- GPS
- Digital camera/device to photograph the site, field activities and key features, as applicable
- Decontamination equipment & supplies.
- Personal protective equipment (PPE) as specified in the project-specific Health and Safety Plan (HSP).

3.3 QC SAMPLING

If non-disposable sampling equipment (e.g., trowel, mixing bowl) is re-used for multiple samples, then equipment rinsate should be collected and disposed of properly. Samples should be collected to verify that proper decontamination methods were performed between samples. A minimum of one sample per major sampling device should be collected per event, if not more frequently (i.e., one per day).

4.0 REQUIRED DOCUMENTATION

The following records generated as a result of implementation of this procedure must be maintained as quality records.

- GPS coordinates for each sample location;
- Field notes provided on a DAR (or field logbook, when applicable);
- Sample Collection Form with descriptions of collected samples, depths, collection times, sample locations, etc.
- Chain-of-custody form.

5.0 ATTACHMENTS/FORMS

None.

6.0 REFERENCES

Innovative Technical Solutions, Inc. (ITSI), 2006. *Final Chemical Data Quality Management Plan*, 8(a) Remedial Action Contract Number N68711-005-D-6403. January.

Standard Operating Procedure

Subsurface Soils: Direct-Push or Drill Rig

PR-TC-02.02.01.03 v2

Reviewed by: ______________________ Date: 20 July 2015
Rogerio Leong, P.G., Geologist

Reviewed by: ______________________ Date: 21 July 2015
Tim Watchers, P.G., Geologist

Approved by: ______________________ Date: 22 July 2015
Jeffrey Hess, Director Technical Services

Review / Revision History:

Version	Changes	Affects Section/Pages	Date	Approval*
1.0	Initial issue	NA	02 Mar 2010	NA
2.0	Update to include sonic drilling method	Section 3.3, pages 5-6	22 Jul 2015	NA

- Approval required for reviews and minor changes only. Substantive revisions to the technical requirements contained in the SOP require review and approval by the signatories to the SOP.

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Table of Contents

1.0 PURPOSE AND SCOPE

The purpose of this standard operating procedure (SOP) is to describe the requirements and procedures for the collection of relatively undisturbed subsurface soil samples from discrete depths during drilling activities. Typical drilling methods associated with subsurface soil sampling activities include but are not limited to: 1) direct push technique (DPT); 2) hollow-stem auger (HSA); 3) sonic; and 4) air rotary casing hammer (ARCH). These drilling methods utilize similar techniques for the collection and retrieval of soil samples from the subsurface, based on use of a solid or split core barrel, and either unlined or lined.

Note: Care should be taken in the selection and use of some drilling methods for the collection of subsurface soil samples suspected to contain volatile organic compounds (VOCs). Drilling methods that generate significant heat during drilling (sonic), or that employ significant volumes of air which may become heated (ARCH and similar methods) could potentially contribute to the loss of VOCs from soil samples collected using these methods.

2.0 ACRONYMS AND DEFINITIONS

For purposes of this procedure, a number of terms and acronyms have the meanings defined below.

ARCH: air rotary casing hammer consists of a non-rotating flush-threaded casing driven in conjunction with a conventional air rotary drill string. Cuttings are cleared from the hole by bit rotation and air circulation. The cuttings are discharged through a cyclone, which separates the air from the formation cuttings to facilitate sampling and allow for the containment of the drill cuttings.

DPT: direct-push technique consists of typically small drill rigs equipped with a percussion hammer and hydraulic pressure to advance the drill string.

FSP: Field Sampling Plan

GPS: global positioning system

HSA: hollow-stem auger uses continuous flight helical augurs to penetrate the soil. As the augers are rotated, soil cuttings are conveyed to the ground surface via the auger flight.

QAPP: Quality Assurance Project Plan

SAP: Sampling and Analysis Plan

Sonic: A drilling method that uses mechanically generated vibrations to drive the drill string. The drill head, attached to drill string, consists of two counter rotating, out-of-balance rollers that cause the drill string to vibrate. Resonance occurs when the frequency of the vibrations equals to the natural frequency of the drill string. The resonance and weight of the drill string along with the downward thrust of the drill head permit penetration of the formation without the addition of drilling fluids.

VOC: volatile organic compound

3.0 PROCEDURES

This section presents several techniques employed to collect soil samples from the subsurface. Three techniques are presented:

1. DPT, which consists of both a method of advancing the drill string and associated soil sampling method together
2. Split-tube (or split-spoon) sampler equipped with sample liners, which can be used by most drilling techniques
3. Core barrel sampler, used by sonic drilling technique

3.1 DIRECT-PUSH TECHNIQUE (DPT)

The collection of subsurface soil samples using DPT employs either single-tube or dual-tube methods. Both methods consist of advancing a drill string using hydraulic pressure and a pneumatic hammer to the target depth. The two methods are described below:

- Single-tube method, as the name implies, involves the use of a single drill string composed of drill rods and/or sample tube to advance to the target depth. Soils can be either be continuously sampled or samples collected from a discrete depth using this method.
  - Continuous sampling of the subsurface soils can be performed using sample tubes ranging in length from 2 to 5 feet containing removable liners manufactured from a variety of materials (e.g., clear PVC, stainless steel, Teflon [PTFE], and clear plastic [PETG]). When the sample tube is full, the entire assembly is brought to the surface.
  - Discrete depth samples can be collected using a sample tube equipped with a retractable drive point. The sample tube is advanced to the desired depth, at which time a narrow rod is lowered through the center of the drill rod into the sample tube to unscrew the drive point. With the drive point loosened, the sample tube is driven the required depth to fill the open sample tube. When full, the sample tube is brought to the surface.

  Note: If samples are needed from deeper layers, the entire process is repeated, introducing the possibility of cross-contamination if the sample is collected from the same borehole. After the tool is removed, sidewall material may slough into the borehole. The acceptability of sloughing cross-contamination should be decided on a case-by-case basis, depending on data quality objectives. If this minimal amount of cross-contamination is not acceptable, samples must be collected from another borehole, or an alternative method employed, such as dual-tube DPT.

- Dual-tube method involves the use of an outer drive casing and inner drive rods. The rods can be attached to either a drive point or a sample tube with liners. In the drive point mode the tool is driven to the desired sampling depth where the drive point is withdrawn and replaced with the barrel sampler. The outer casing and sampler are then driven the length of the sample tube (2 to 5 feet depending upon the equipment) at which point the sample tube is withdrawn. Continuous sampling can be carried out quickly by using multiple samplers. The dual-tube sampling system is recommended for continuous sampling as the outer casing prevents sloughing and cross contamination from other depths.

The composition of the sample liners used to collect soil samples by DPT should be discussed with the project chemist to make certain there is no chemical reaction with the suspected constituents at the site.

3.1.1 Sample Liner

Sample collection procedures for soil samples obtained in sample tubes equipped with liners consist of the following:

1. Place a pre-cleaned liner of appropriate length in the sample tube. Advance the sampler the appropriate depth, then retrieve the sampler from the ground.
2. Retrieve the sampler with liner from the driller. Make sure to note which end represents the “top” (nearest the ground surface) and which represents the “bottom” (the deepest soil).
3. Retrieve the sample liner from the sampler. Place the sample liner on a clean work surface.
4. Observe and classify the soil in the sample liner. Record your findings on the boring log form. Note the presence of visible staining or other signs of contamination.
5. Identify the interval desired for chemical analysis. This could be a specific depth interval, or based on observations of the soil in the sample liner (e.g., visible staining, fine-grained layer, etc.).
6. Hand saw the desired interval from the sample liner. The sample interval is typically 6 inches, but the actual length may depend on diameter of the sample liner, needed sample volume, target depth, etc., and will be specified in the site-specific QAPP.
7. Collect any required VOC samples from the target end of the sample using an approved VOC sampling device (as specified in the QAPP and consistent with SOP PR-TC-02.02.01.05).
8. The ends of the cut section of sample liner are fitted with Teflon patches, and then covered with plastic friction caps. (The end cap diameter can be stretched by hand if difficult to fit over the ends. Tipping the cap open to the side and partially sliding over the end of the tube and while twisting and pushing down helps.) The end caps should fit snugly. Security tape may be placed around the end caps to

prevent tampering, if specified in the QAPP.

9. The soil samples are then cleaned and labeled with the sample ID, date and time, depth interval, and requested analyses. Record the sample on the chain-of-custody form and complete the sample collection log, as appropriate. Record the sample interval on the boring log.
10. Place the soil samples into plastic zip-lock type bags and place them in an iced and insulated cooler.

3.2 SPLIT-TUBE SAMPLERS

A split-tube (also known as split-spoon) sampler consists of a split-barrel typically of 18 inches in length (but can range in length to 5 feet) that can be left open or lined with sample sleeve(s). A typical application consists of lining an 18-inch split-tube sampler with pre-cut 6-inch sample sleeves composed of brass or stainless steel, but other applications include using longer split-tube samplers equipped with a liner composed of lexan or similar material.

Typically the split spoon sampler is driven to the target depth using a 140-pound hammer ahead of the drill bit while drilling has stopped, although split-tube samplers can be placed and advanced during drilling. In loose soils, a plastic or stainless steel sand catcher can be placed just inside of the sampler's drive shoe to help retain the sample during retrieval.

The ARCH method employs significant volumes of air during drilling that may become heated, which could potentially contribute to loss of VOCs in the soil samples. For this reason, if VOC samples are needed and the ARCH drilling technique is being used, it is preferred to collect VOC samples from soil retrieved from a split-tube sampler driven ahead of the drill bit several feet after drilling has stopped.

3.2.1 Open Sampler

Sample collection procedures for soil samples obtained from split-tube samplers left open (without sample sleeves) consist of the following:

1. Advance a clean sampler the appropriate depth, then retrieve the sampler from the ground.
2. Retrieve the sampler from the driller. Make sure to note which end represents the "top" (nearest the ground surface) and which represents the "bottom" (the deepest soil).
3. Place the sampler on a clean work surface, and break open the sampler by unscrewing the sampler head and sampler shoe from the ends of the sampler and separating the two halves of the sampler tube to expose the soil core.
4. Observe and classify the soil in the sampler tube and the soil remaining in the sample shoe (from the tip of the sampler). Record your findings on the boring log form. Note the presence of visible staining or other signs of contamination.
5. Identify the interval desired for chemical analysis. This could be a specific depth interval, or based on observations of the soil in the sample sleeves (e.g., visible

staining, fine-grained layer, etc.).

6. Collect the desired soil using a sampling spoon (clean stainless steel or Teflon, or disposable one-time use) and place into clean glass sample jars provided by the laboratory (due to the exposure of the soil core to the atmosphere, this method is not appropriate for soils suspected as containing VOCs). Security tape may be placed around the cap to prevent tampering, if specified in the QAPP.
7. The soil samples are then cleaned and labeled with the sample ID, date and time, depth interval, and requested analyses. Record the sample on the chain-of-custody form and complete the sample collection log, as appropriate. Record the sample interval on the boring log.
8. Place the soil samples into plastic zip-lock type bags and place them in an iced and insulated cooler.

3.2.2 Sample Sleeves

Sample collection procedures for soil samples obtained from split-tube samplers equipped with 6-inch sample sleeves consist of the following:

1. Place the appropriate number of pre-cleaned 6-inch-long brass or stainless steel sleeves in the split-tube sampler. Advance the sampler the appropriate depth, then retrieve the sampler from the ground.
2. Retrieve the sampler with sleeves from the driller. Make sure to note which end represents the “top” (nearest the ground surface) and which represents the “bottom” (the deepest soil).
3. Retrieve the sampler with sleeves from the driller. Place the sampler on a clean work surface, and break open the sampler by unscrewing the sampler head and sampler shoe from the ends of the sampler and separating the two halves of the sampler tube to expose the sample sleeves.
4. Observe and classify the visible soil in the ends of the sample sleeves and the soil remaining in the sample shoe (from the tip of the sampler). Record your findings on the boring log form. Note the presence of visible staining or other signs of contamination.
5. Identify the interval desired for chemical analysis. This could be a specific depth interval, or based on observations of the soil in the sample sleeves (e.g., visible staining, fine-grained layer, etc.).
6. Collect any required VOC samples from the target end of the sample using an approved VOC sampling device (as specified in the QAPP and consistent with SOP PR-TC-02.02.01.05).
7. The ends of the sample sleeve are fitted with Teflon patches, and then covered with plastic friction caps. (The end cap diameter can be stretched by hand if difficult to fit over the ends. Tipping the cap open to the side and partially sliding over the end of the tube and while twisting and pushing down helps.) The end caps should fit snugly. Security tape may be placed around the end caps to

prevent tampering, if specified in the QAPP.

8. The soil samples are then cleaned and labeled with the sample ID, date and time, depth interval, and requested analyses. Record the sample on the chain-of-custody form and complete the sample collection log, as appropriate. Record the sample interval on the boring log.
9. Place the soil samples into plastic zip-lock type bags and place them in an iced and insulated cooler.

3.3 CORE BARREL SAMPLERS

The core barrel sampler is used in sonic drill rigs, with dual wall core barrels typically employed. The dual wall core barrel is designed to take continuous cores from rock and very hard layers. Sample cores are typically either 3 or 4 inches in diameter, and are typically solid but split-tube cores are available. The combination of the sonic head vibration, sonic casing rotation and down force causes the soil to loosen at the bit face, allowing the casing and sampling core barrel to advance. The core barrel advances within the sonic casing thereby obtaining a continuous core sample. In the typical case of solid core barrel sampler, the sample is extruded into a soft plastic liner or core box, as needed. If split-tube core barrel sampler with liner is used, then the technique would be consistent with the DPT technique presented in Section 3.1.1 above.

The sonic method generates significant heat during drilling that could potentially contribute to loss of VOCs concentrations of the soil samples. For this reason, if VOC samples are needed and the sonic drilling technique is being used, it is preferred to collect VOC samples from soil retrieved from a split-tube sampler driven ahead of the drill core several feet after drilling has stopped.

Sample collection procedures for soil samples obtained from a solid core barrel sampler consist of the following:

1. Retrieve the extruded sample from the driller. Make sure to note which end represents the “top” (nearest the ground surface) and which represents the “bottom” (the deepest soil).
2. Place the extruded sample on a clean table surface. If soil core was extruded into a soft plastic liner, cut open the liner to expose the soil core.
3. Perform a vapor screening with a photoionization detector through the soil core to check on potential volatile organic vapors. Measure the core length to determine the recovery and sampling depths.
4. Identify the interval desired for chemical analysis. This could be a specific depth interval, or based on observations of the soil in the sample core (e.g., visible staining, fine-grained layer, etc.).
5. Split the soil core open with a stainless steel spatula and collect samples from the center of the sample core using a stainless steel or disposable scoop. Transfer soils to the sample jars.
6. Observe and classify the visible soil and the soil remaining in the sample shoe

(from the tip of the sampler). Record your findings on the boring log form. Note the presence of visible staining or other signs of contamination.

7. The soil samples in the jars are then cleaned and labeled with the sample ID, date and time, depth interval, and requested analyses. Record the sample on the chain-of-custody form and complete the sample collection log, as appropriate. Record the sample interval on the boring log.
8. Pack each soil sample jar with bubble wrap and placed it into plastic zip-lock type bags and store it in an iced and insulated cooler.

3.4 EQUIPMENT

Besides the equipment mentioned above in each procedure, the following additional items may be required for this procedure:

- Commercial sampler and appropriate liners or sample sleeves
- Approved VOC sampling device (if needed for collection of VOC samples)
- Measuring tape
- Sample container(s), labels, coolers, etc., as specified in the SAP or FSP
- GPS unit
- Field logbook or sample collection logs and boring logs
- Knife or flat edged tool to cut open the remaining core for soil classification
- Munsell® soil color chart
- Dilute hydrochloric acid, if presence of carbonate soils is possible

3.5 QC SAMPLING

If sampling equipment is re-used between samples (i.e., sampler), then equipment rinsate samples should be collected to verify proper decontamination between samples. A minimum of one equipment rinsate sample per major sampling device should be collected per event, if not more frequently (i.e., one per day).

4.0 REQUIRED DOCUMENTATION

The following records generated as a result of implementation of this procedure must be maintained as quality records.

- GPS coordinates
- Soil Boring Log
- Chains of Custody
- Field notes

5.0 ATTACHMENTS

None.

6.0 FORMS

None.

7.0 REFERENCES

Ohio Environmental Protection Agency, 2005. *Use of Direct Push Technologies for Soil and Ground Water Sampling, Technical Guidance for Ground Water Investigations, Chapter 15*, February.

U.S. Environmental Protection Agency (USEPA). *Soil and Soil-Gas Samplers.* http://www.clu-in.org/characterization/technologies/soilandsoilgassamp.cfm, 28 February 2010.

Gilbane

Standard Operating Procedure

Soil: Volatile Organic Compound (VOC) Sampling
PR-TC-02.02.01.05 v1.3

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Version	Changes	Affects Section/Pages	Date	Approval*
1.0	Initial Issue	NA	02 Mar 2010	NA
1.1	Addition of Terra Core System to SCDs	3.2 and 3.3	05 Oct 2011	JH
1.2	Updated procedures to incorporate SW846 Update 4 changes to preservation and hold times.	Pages 3, 5-8, 11-12	30 Jul 2013	JH
1.3	Updated organization name. No other changes necessary.	All	20 Jul 2015	JHess

- Approval required for reviews and minor changes only. Substantive revisions to the technical requirements contained in the SOP require review and approval by the signatories to the SOP.

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Table of Contents

1.0 PURPOSE AND SCOPE

The purpose of this standard operating procedure is to describe the requirements and procedures for the collection, packaging and transport of soil samples for the analysis of volatile organic compounds (VOCs). This SOP is focused on the preparation and preservation of soil samples in compliance with United States Environmental Protection Agency (USEPA) Method 5035 (USEPA, 1997) and updated USEPA Method 5035A (USEPA, 2002) and associated agency guidance documents such as the United States Department of Defense (USDoD) Quality Systems Manual, Version 5.0 (DoD, 2013).

Note: There are several approaches to the collection of VOC soil samples. However, the methods and their associated sampling and/or storage devices are not interchangeable. Also, each of the methods has limitations in their application and use, so the decision on which method to use should consider both the benefits and limitations of each method.

2.0 ACRONYMS AND DEFINITIONS

For purposes of this procedure, a number of terms and acronyms have the meanings defined below.

DQOs: data quality objectives

GPS: global positioning system

“high concentration”: refers to concentrations of a volatile organic compound (VOC) greater than 200 ug/kg

“low concentration”: refers to concentrations of a volatile organic compound (VOC) typically ranging from 0.5 ug/kg to 200 ug/kg

MFSD: multi-function sampling device

ml: milliliter

MS: matrix spike

MSD: matrix spike duplicate

PTFE: polytetrafluoroethylene

QAPP: Quality Assurance Project Plan

SCD: sub-coring device

USACE: United States Army Corps of Engineers

USEPA: United States Environmental Protection Agency

VOA: volatile organic analysis

VOC: volatile organic compound

3.0 PROCEDURES

The intent of this SOP is to present several acceptable procedures for the collection of VOC soil samples, consistent with EPA Method 5035A. The actual selected procedure will be specified in the project-specific QAPP. However, the following two steps are applicable to all the methods described in this SOP:

1. When the concentration of VOCs is unknown, a sample set typically is comprised of three (3) sub-samples of 5 grams of soil each.
2. To determine VOC concentrations on a dry weight basis, in the absence of an additional sample aliquot of sufficient volume to determine dry weight basis, a separate container (2-ounce jar or 40 ml vial) should be filled with soil that is co-located with each sample.

Each procedure has its own set of benefits and limitations. Selection of the appropriate procedure should be based primarily on which procedure best addresses the data quality objectives (DQOs) while considering the limitations imposed by field conditions and sampling requirements. Attachment A provides a brief discussion of some of the limitations of the specific procedures. Some of the limitations of the different procedures include:

3.1 USE OF MULTI-FUNCTION SAMPLING DEVICE

Multi-function sampling devices (MFSDs), such as the En Core® Sampler, act as both a coring tool and sample storage container, allowing for the collection of soil samples directly into the storage container with zero or minimal headspace. Currently approved MFSDs include the following:

- En Core® Sampler
- Core N' One™ soil sampling system

The procedures for the collection of the soil samples using the approved MFSDs are provided below. A soil sample typically is comprised of a minimum of 3 MFSDs containing 5 grams of soil each.

3.1.1 Encore Sampler

3.1.1.1 Required Equipment

- En Core® T-Handle
- En Core® Samplers

3.1.1.2 Sampling Procedure

1. Assemble the En Core® Sampler by holding the coring body and pushing the plunger rod down until the small o-ring rests against the tabs. Depress the locking lever on the En Core® T-handle and place the plunger end of the coring body into the open end of the T-handle. Align the two slots on the coring body with the two locking pins in the T-handle. Twist the coring body clockwise to lock the pins in the slots. Finally, check to ensure that the coring body is locked in place.

2. Collect the En Core® sample by grasping the T-Handle with the open end of the coring body facing the soil sample. Using the T-Handle, push the sampler into soil until coring body is completely full. The coring body is full when the small o-ring is centered in the viewing hole in the T-Handle. Remove the sampler from the soil. Push and twist cap on the exposed end of the coring body until the ridges on the coring body snap into the grooves of the cap. Check to ensure that cap is properly secured.

3. Prepare the sample for shipment by removing the T-Handle from the En Core® Sampler by depressing the locking lever on T-Handle and then twist and pull the En Core® Sampler from T-Handle. Lock the plunger by rotating the extended plunger rod fully counter-clockwise until the wings rest firmly against the tabs. Attach the completed circular label to the cap of the coring body.

4. Return the full En Core® Sampler to the zipper bag. Seal the bag and immediately place the bag in an ice chest filled with ice.

3.1.2 Core N' One™ Sampling System

3.1.2.1 Required Equipment

- Core N' One™ Soil Handle
- Core N' One™ Soil Capsules

3.1.2.2 Sampling Procedure

1. Remove capsule from zip lock and insert prongs into the slots of the Core N' One™ handle. Make a one-quarter turn to the right to lock the capsule in place.
2. Unscrew the capsule cap and bore the beveled edge opening into the soil. You can determine if you have taken a full 5-gram sample by holding the capsule up to the light. The dark shading of the soil should be at the top level of the cap threads.
3. Screw the cap tight. The edge of the cap should touch the center rib of the capsule.
4. Insert the capsule into the zip lock for transport to the lab.

3.1.3 Additional Analytical Requirements

Using MFSDs require specific handling procedures for the samples after collection and by the analytical laboratory.

Field preservations options include the following:

a) Place the samples in an iced cooler and chill and maintain the sample at the appropriate temperature for the specified method (as identified in the project-specific plans and/or as listed in SOP PR-TC-02.04.01.01, Sample Handling, Packaging and Shipping). Deliver the samples to the laboratory quickly to allow for analysis or extraction of the samples by the laboratory within 48 hours of sample collection time.

b) Place the samples in a freezer and chill and maintain the sample at < -7°C, and deliver the samples to the laboratory quickly to allow for analysis or extraction of the samples by the laboratory within 48 hours of sample collection time.

Although alternative a) is the normal procedure for most soils, alternative b) is necessary with biologically active soils potentially containing aromatic hydrocarbons (i.e., benzene).

Extraction options for the analytical laboratory include the following:

1) Analysis of the sample within 48 hours of sample collection.
2) Extrude core into unpreserved pre-tared VOA vial at the laboratory. For low-level analysis, the soil can be extruded, weighed and placed into a pre-tared VOA vial containing reagent-grade extractant water (the preferred low-level method, see Section 3.1.4 below). The laboratory then freezes the sample at < -7°C. The sample must then be analyzed within 14 days of the sample collection date.
3) Extrude core into preserved VOA vial at the laboratory. For low-level analysis, the soil can be extruded, weighed and preserved in a pre-tared VOA vial containing sodium bisulfate solution (not recommended, see Section 3.1.4 below). For high-level analysis, the soil can be extruded, weighed, and preserved with methanol. After extrusion of the soil into an appropriate extraction fluid, the sample must be analyzed within 14 days of the sample collection date.

Additionally, in order to determine VOC concentrations on a dry weight basis, in the absence of one or more additional sample aliquots of sufficient volume to determine dry weight basis, a separate container (2-ounce jar or 40 ml vial) should be filled with soil that is co-located to each sample collection point. Sample nomenclature that links this sample to the VOC sample containers that comprise a sample set should be used.

3.1.4 Method Incompatibilities

Biologically active samples may result in the rapid loss of aromatic hydrocarbons during the initial 48 hours after sampling, and thus should be immediately chemically preserved or frozen using dry ice.

Sample preservation with sodium bisulfate solution presents four potential problems:

i. Acid preservation may cause the chemical breakdown of certain reactive VOC compounds in the soil sample, specifically styrene, acrylonitrile, vinyl chloride, and 2- chloroethylvinyl ether.
ii. In soil samples with a high proportion of organic material, acid preservation may generate acetone as a byproduct.
iii. Calcareous soil samples may effervesce upon contact with sodium bisulfate solution and cause VOC loss.
iv. Calcareous soil samples may increase the pH of the preservation fluid above 2.0, producing a sample in an unpreserved state. Accordingly, the soils at the site should be evaluated for potential problems prior to sampling activities. In cases where preservation by acid is a potential problem, an alternate sample collection method should be utilized.

3.2 USE OF SUB-CORING DEVICE AND FIELD PRESERVATION

An alternative to using MFSDs consists of using sub-coring devices (SCDs) and field preservation of the samples. Benefits of this method include less-expensive sampling devices (e.g., Lock N' Load™), and potentially longer holding times. However, SCDs and field preservation involves more physical handling of the samples in the field, including weighing of the samples, potentially impacting production rates. Also, preservatives for low- or high-level analysis pose significant problems themselves. This method should be used with caution and only after full consideration of the inherent problems in the method.

Approved SCDs include:

- Lock N' Load™ sampling system
- EasyDraw Syringe®
- Terra Core® Sampler

The procedures for the collection of the soil samples using the approved SCDs are provided below. A soil sample typically is comprised of a minimum of 3 field preserved vials containing 5 grams of soil each.

3.2.1 Lock N' Load™ Sampling System

3.2.1.1 Required Equipment

- Lock N' Load™ soil handle
- Lock N' Load™ soil syringe
- VOA vials with preservative (pre-tared)

3.2.1.2 Sampling Procedure

1. Insert Lock N' Load™ Syringe into Lock N' Load™ Handle at base opening. Turn the locking portion of the syringe into the O gram setting. Remove end cap from the Lock N' Load™ Syringe. Position the Lock N' Load™ Handle to the desired soil sample volume (5 grams in triplicate). To do this, slide the slot portion of the handle down the fitted track, then turn the handle one quarter to the right at the desired setting.
2. Push the syringe into the soil until the plunger portion of the syringe makes contact with the base of the Lock N' Load™ Handle.
3. Transfer the soil from the syringe into a pre-tared 40 ml VOA vial containing the appropriate preservative, if any, by turning the Lock N' Load™ Handle one quarter to the left (back to the fitted track) and pushing down. Slightly tilt the VOA vial to avoid splashing and potentially losing some of the preservative. Avoid getting dirt on the threads of the vial. Cap the vial and store the sample at the required temperature until time of analysis.

3.2.2 EasyDraw Syringe® and PowerStop Handle®

3.2.2.1 Required Equipment

- PowerStop Handle®

- EasyDraw Syringe®
- VOA vials with preservative (pre-tared)

3.2.2.2 Sampling Procedure

1. Load Sampling Device. Insert the EasyDraw Syringe® into the appropriate slot on the Powerstop Handle® and remove end cap from syringe. For low-level analysis, insert syringe into one of the three positions of the device for collection of 5 gram samples. Use the heavy position for dense clay, the light position for dry sandy soil, and the medium position for all others.
2. Collect Sample. Push the EasyDraw Syringe® into freshly exposed soil. Continue pushing until the soil column inside the syringe has forced the plunger to the stopping point. The soil plug should be flush with the mouth of the sampler. The EasyDraw Syringe® delivers approximately 5, 10 or 13 grams. Actual weight will be determined at the laboratory.
3. Eject Sample Into Vial. Remove the syringe from the Powerstop Handle®. Insert syringe into open end of a pre-tared 40-ml VOA vial containing the appropriate preservative, if any. Extrude the sample into the vial by pushing on the syringe plunger. Slightly tilt the VOA vial to avoid splashing and potentially losing some of the preservative. Avoid getting dirt on the threads of the vial. Cap the vial and store the sample at the required temperature until time of analysis.

3.2.3 Terra Core® Sampler

3.2.3.1 Required Equipment

- Terra Core® Sampler
- VOA vials with preservative (pre-tared)

3.2.3.2 Sampling Procedure

1. With the plunger seated in the handle, push the Terra Core® into freshly exposed soil until the sample chamber is filled. A filled chamber will deliver approximately 5 or 10 grams of soil.
2. Wipe all soil or debris from the outside of the Terra Core® sampler. The soil plug should be flush with the mouth of the sampler. Remove any excess soil that extends beyond the mouth of the sampler.
3. Rotate the plunger that was seated in the handle top 90° until it is aligned with the slots in the body. Place the mouth of the sampler into the 40ml VOA vial containing the appropriate preservative and extrude the sample by pushing the plunger down. Slightly tilt the VOA vial to avoid splashing and potentially losing some of the preservative, and quickly place the lid back on the 40ml VOA vial. Avoid getting dirt on the threads of the vial. Cap the vial and store the sample at the required temperature until time of analysis.

3.2.4 Additional Analytical Requirements

Using field preservation requires specific handling procedures for the samples after collection and by the analytical laboratory. Requirements vary depending on the specific preservation method, so care needs to be taken to follow the specific procedure carefully.

Preservation options include the following:

b) Field preservation with methanol. After extruding the soil samples into pre-tared 40-ml VOA vials preserved with methanol, the vials are re-weighed in the field, and then are chilled at the required temperature in a cooler and shipped with adequate ice to ensure that the required temperature is maintained during transport to the laboratory. The samples must arrive at the laboratory within 48 hours of the sample collection time. The vials are weighed again at the stationary laboratory to verify that no methanol was lost during transport. The laboratory must prepare and analyze the samples within 14 days of the sample collection date. This technique applies only to high-level analysis so it should be used only if detection limits of greater than 200 ug/kg are appropriate.

c) Field preservation with sodium bisulfate solution. After extruding the soil samples into pre-tared 40-ml VOA vials preserved with sodium bisulfate solution, the samples are kept chilled at the required temperature in a cooler and shipped with adequate ice to ensure that the required temperature is maintained during transport to the laboratory. The samples must arrive at the laboratory within 48 hours of the sample collection time. The laboratory must prepare and analyze the samples within 14 days of the sample collection date. This preservation technique provides detection limits to approximately 0.5 ug/kg (low-level analysis). However, sample preservation with sodium bisulfate solution presents four potential problems:

   i. Acid preservation may cause the chemical breakdown of certain reactive VOC compounds in the soil sample, specifically styrene, acrylonitrile, vinyl chloride, and 2- chloroethylvinyl ether.

   ii. In soil samples with a high proportion of organic material, acid preservation may generate acetone as a byproduct.

   iii. Calcareous soil samples may effervesce upon contact with sodium bisulfate solution and cause VOC loss.

   iv. Calcareous soil samples may increase the pH of the preservation fluid above 2.0, producing a sample in an unpreserved state. Accordingly, the soils at the site should be evaluated for potential problems prior to sampling activities. In cases where preservation by acid is a potential problem, an alternate sample collection method should be utilized.

d) Field extraction into reagent water and analysis within 48 hours. After extruding the soil samples into pre-tared 40-ml VOA vials containing reagent-grade extractant water, the samples are kept chilled at the required temperature in a cooler and shipped with adequate ice to ensure that the required temperature is maintained during transport to the laboratory. Upon receipt of the samples, the laboratory chills the vials to the required temperature and analyzes the samples within 48 hours of the sample collection time. This technique applies to samples for low-level and high-level analysis.

Note: Extruding soil samples into vials containing reagent-grade extractant water may have an adverse effect on sample results in that water may actually promote bacterial degradation of aromatic hydrocarbons. Likewise, some VOCs may be unstable in reagent water, such as 1,1,2,2-tetrachloroethane. Accordingly, reagent water-filled vials should only be used for chemicals that do not readily biodegrade or breakdown.

e) Field extraction into reagent water and field freezing. After extruding the soil samples into pre-tared 40-ml VOA vials containing reagent-grade extractant water, the samples are frozen to <-7°C in a cooler in the field and shipped with adequate dry ice to ensure that <-7°C is maintained during transport to the laboratory. The vials should not be frozen below -20°C due to potential problems with the vial seals. A temperature blank should be included with the samples so that the laboratory can verify the temperature upon receipt and the arrival temperature of the samples should be annotated on the chain-of-custody form. During the freezing process, the vials should be stored in a 45° angle to prevent water expansion from shattering the vials. To avoid potential rupture of the PTFE-lined septum caps, the dry ice should not directly contact the top of the vials. The laboratory must immediately freeze the sample vials to <-7°C upon receipt. The samples may be held at <-7°C for up to 7 days prior to analysis from the sample collection date. This technique applies to samples for low-level and high-level analysis. This option is used in the situations where it is difficult or impossible to deliver the samples to the laboratory within 48 hours of the sample collection time.

f) Field extraction into reagent water and laboratory freezing. After extruding the soil samples into pre-tared 40-ml VOA vials containing reagent-grade extractant water, the samples are kept chilled at the required temperature in a cooler and shipped with adequate ice to ensure that the required temperature is maintained during transport to the laboratory. The laboratory must receive and immediately freeze the vials to <-7°C within 48 hours of the sample collection time. During the freezing process, the vials should be stored in a 45° angle to prevent water expansion from shattering the vials. The samples may be held at <-7°C for up to 7 days prior to analysis from the sample collection date. The vials should not be frozen below -20°C due to potential problems with the vial seals. This technique applies to samples for low-level and high-level analysis.

Additionally, in order to determine VOC concentrations on a dry weight basis, in the absence of one or more additional sample aliquots of sufficient volume to determine dry weight basis, a separate container (2-ounce jar or 40 ml vial) should be filled with soil that is co-located to each sample collection point. Sample nomenclature that links this sample to the VOC sample containers that comprise a sample set should be used.

3.2.5 Method Incompatibilities

3.2.4.1 Aromatic Hydrocarbons

Chemicals, such as aromatic hydrocarbons (e.g., benzene), are subject to VOC loss by biodegradation under certain sampling procedures. Accordingly, to obtain aromatic hydrocarbon soil concentrations that are representative of site conditions, only a subset of the available options are available for use. To reduce the biological activity in soil contaminated with aromatic hydrocarbons, soil samples should be preserved with methanol or sodium bisulfate solution in the field, or frozen in the field at <-7°C in non-preserved VOA vials. Under no circumstances should soil samples contaminated with aromatic hydrocarbons be collected in the field with VOA vials containing reagent-grade extractant water. The introduction of unpreserved water to the soil sample may enhance the biodegradation of the aromatic hydrocarbons.

3.2.4.2 Chemical Reactions

Acid preservation of soil by sodium bisulfate solution, whether done in the field or in the stationary laboratory, may cause the chemical breakdown of certain compounds, including vinyl chloride. Some olefins, ketones, esters, ethers, and sulfides may react under low pH conditions, yielding analytical results that are not representative of soil conditions. Hence, precaution should be taken when preserving soil samples with sodium bisulfate solution when these compounds are present. If the degree of potential chemical reaction is unknown, an alternative procedure should be used.

3.2.4.3 Calcareous Soil

Calcareous soil samples may react upon contact with sodium bisulfate solution, causing VOC loss through effervescence and potentially cause failure of the VOA vial septum through pressure buildup. Additionally, when soil samples are highly calcareous in nature, the sodium bisulfate preservative solution may not be strong enough to reduce the pH of the aqueous solution to below 2.0, potentially rendering the preservative useless. If carbon dioxide is generated due to carbonate reaction with the acid, the carbon dioxide in the VOA vial may interfere with the detector of the analytical equipment. Hence, precaution should be taken when preserving soil samples with sodium bisulfate solution when carbonates are present.

3.3 USE OF SUB-CORING DEVICE AND EMPTY VIAL

An alternative to using SCDs with field preservation consists of field extruding the samples into clean VOA vials. Benefits of this method include use of less-expensive SCDs and potentially longer holding times. However, the empty vial method involves more physical handling of the samples in the field, including weighing of the samples, potentially impacting production rates. This method should be used with caution and only after full consideration of the inherent problems in the method.

Soil samples for the empty vial method are collected using a sub-coring device. Approved sub-coring devices include:

- Lock N' Load™ sampling system
- EasyDraw Syringe®
- Terra Core® Sampler

The procedures for the collection of the soil samples using the approved sub-coring devices are provided below. A soil sample typically is comprised of a minimum of 3 empty vials containing 5 grams of soil each.

3.3.1 Lock N' Load™ Sampling System

3.3.1.1 Required Equipment

- Lock N' Load™ soil handle

- Lock N' Load™ soil syringe
- VOA vials (pre-tared)

3.3.1.2 Sampling Procedure

1. Insert Lock N' Load™ Syringe into Lock N' Load™ Handle at base opening. Turn the locking portion of the syringe into the O gram setting. Remove end cap from the Lock N' Load™ Syringe. Position the Lock N' Load™ Handle to the desired soil sample volume (5 grams in triplicate). To do this, slide the slot portion of the handle down the fitted track, then turn the handle one quarter to the right at the desired setting.
2. Push the syringe into the soil until the plunger portion of the syringe makes contact with the base of the Lock N' Load™ Handle.
3. Transfer the soil from the syringe into a pre-tared empty 40 ml VOA vial by turning the Lock N' Load™ Handle one quarter to the left (back to the fitted track) and pushing down. Avoid getting dirt on the threads of the vial. Cap the vial and store the sample at the required temperature until time of analysis.

3.3.2 EasyDraw Syringe® and PowerStop Handle®

3.3.2.1 Required Equipment

- PowerStop Handle®
- EasyDraw Syringe®
- VOA vials (pre-tared)

3.3.2.2 Sampling Procedure

1. Load Sampling Device. Insert the EasyDraw Syringe® into the appropriate slot on the Powerstop Handle® and remove end cap from syringe. For low-level analysis, insert syringe into one of the three positions of the device for collection of 5 gram samples. Use the heavy position for dense clay, the light position for dry sandy soil, and the medium position for all others.
2. Collect Sample. Push the EasyDraw Syringe® into freshly exposed soil. Continue pushing until the soil column inside the syringe has forced the plunger to the stopping point. The soil plug should be flush with the mouth of the sampler. The EasyDraw Syringe® delivers approximately 5, 10 or 13 grams. Actual weight will be determined at the laboratory.
3. Eject Sample Into Vial. Remove the syringe from the Powerstop Handle®. Insert syringe into open end of a pre-tared empty 40-ml VOA vial. Extrude the sample into the vial by pushing on the syringe plunger. Avoid getting dirt on the threads of the vial. Cap the vial and store the sample at the required temperature until time of analysis.

3.3.3 Terra Core® Sampler

3.3.3.1 Required Equipment

- Terra Core® Sampler

- VOA vials (pre-tared)

3.3.3.2 Sampling Procedure

1. With the plunger seated in the handle, push the Terra Core® into freshly exposed soil until the sample chamber is filled. A filled chamber will deliver approximately 5 or 10 grams of soil.
2. Wipe all soil or debris from the outside of the Terra Core® sampler. The soil plug should be flush with the mouth of the sampler. Remove any excess soil that extends beyond the mouth of the sampler.
3. Rotate the plunger that was seated in the handle top 90° until it is aligned with the slots in the body. Place the mouth of the sampler into the 40ml VOA vial containing the appropriate preservative and extrude the sample by pushing the plunger down. Slightly tilt the VOA vial to avoid splashing and potentially losing some of the preservative, and quickly place the lid back on the 40ml VOA vial. Avoid getting dirt on the threads of the vial. Cap the vial and store the sample at the required temperature until time of analysis.

3.3.4 Additional Analytical Requirements

Using the empty vial method requires specific handling procedures for the samples after collection and by the analytical laboratory. Requirements vary depending on the specific preservation method, so care needs to be taken to follow the specific procedure carefully.

Handling options include the following:

a) Field extraction and analysis within 48 hours. After extruding the soil samples into pre-tared empty 40-ml VOA vials, the samples are kept chilled at the required temperature in a cooler and shipped with adequate ice to ensure that the required temperature is maintained during transport to the laboratory. Upon receipt of the samples, the laboratory chills the vials to the required temperature and analyzes the samples within 48 hours of the sample collection time. This technique applies to samples for low-level and high-level analysis.

b) Field extraction and laboratory freezing. After extruding the soil samples into pre-tared empty 40-ml VOA vials, the samples are kept chilled at the required temperature in a cooler and shipped with adequate ice to ensure that the required temperature is maintained during transport to the laboratory. The laboratory must receive and immediately freeze the vials to <-7°C within 48 hours of the sample collection time. The samples may be held at <-7°C for up to 14 days prior to analysis from the sample collection date. The vials should not be frozen below -20°C due to potential problems with the vial seals. This technique applies to samples for low-level and high-level analysis.

c) Field extraction and laboratory preservation. After extruding the soil samples into pre-tared empty 40-ml VOA vials, the samples are kept chilled at the required temperature in a cooler and shipped with adequate ice to ensure that the required temperature is maintained during transport to the laboratory. The samples must arrive at the laboratory within 48 hours of the sample collection time. The laboratory then must preserve the sample using methanol. The laboratory must prepare and analyze the samples within 14 days of the sample collection date. This technique applies only to high-level analysis so it should be used only if detection limits of greater than 200 ug/kg are appropriate.

d) Field extraction and field freezing. After extruding the soil samples into pre-tared empty 40-ml VOA vials, the samples are immediately frozen to <-7°C and shipped with adequate dry ice to ensure that <-7°C is maintained during transport to the laboratory. The laboratory must receive and immediately freeze the vials to <-7°C. The samples may be held at <-7°C for up to 14 days prior to analysis from the sample collection date. The vials should not be frozen below -20°C due to potential problems with the vial seals. This technique applies to samples for low-level and high-level analysis.

Additionally, in order to determine VOC concentrations on a dry weight basis, in the absence of one or more additional sample aliquots of sufficient volume to determine dry weight basis, a separate container (2-ounce jar or 40 ml vial) should be filled with soil that is co-located to each sample collection point. Sample nomenclature that links this sample to the VOC sample containers that comprise a sample set should be used.

3.3.5 Method Incompatibilities

Biologically active samples may result in the rapid loss of aromatic hydrocarbons during the initial 48 hours after sampling, and thus should be immediately chemically preserved or frozen. Thus, the use of field freezing is required when using the empty vial method for biologically active samples suspected of containing aromatic hydrocarbons.

3.4 EQUIPMENT

Specific equipment requirements are discussed in the procedures above. In addition to the materials identified above, many of the procedures require the following:

- Appropriate clean laboratory-provided pre-tared VOA vials with selected preservative
- A scale capable of weighing 100 grams and accurate to ± 0.1 grams.

3.5 QUALITY CONTROL SAMPLES

QC samples are important to measure potential impacts to the accuracy and representativeness of the VOC samples collected. Specific QC samples important to the procedures presented in this SOP include:

- Trip blanks
- Temperature blanks
- MS/MSD samples
- Other recommended QC samples

3.5.1 Trip Blanks

Soil samples can be contaminated by diffusion of VOCs through the septum on VOA vials or through the seal on MFSDs during shipment and storage. Trip blanks are samples that accompany the environmental samples during the sampling operations and transport to the laboratory. The trip blanks may be prepared with laboratory grade methanol, sodium bisulfate solution, or reagent water, dependent on the field methods, and could also consist of laboratory-certified soil, and can be carried through sampling and handling protocols as a check on such contamination.

Generally one trip blank should be used for each field sample cooler, as specified in the QAPP. However, at a minimum, one trip blank should be used per day. The trip blank should remain unopened throughout sampling operations and labeled by date, such as TB022510-01 (for cooler no. 1 trip blank sent on February 25, 2010), or similar nomenclature as specified in the QAPP.

3.5.2 Temperature Blanks

Temperature blanks should be used so that the laboratory can verify the temperature upon receipt of the samples. In the case of field freezing, the temperature blanks should be frozen upon arrival at the laboratory. The temperature of the samples upon arrival should be annotated on the chain-of-custody form and also mentioned in the laboratory narrative that accompanies the analytical results. A temperature blank routinely consists of a vial filled with blank water (deionized water is acceptable).

3.5.3 Matrix Spike and Matrix Spike Duplicate Samples

An important measure of the performance of an analytical method relative to the specific sample matrix of interest is the matrix spike and matrix spike duplicate (MS/MSD). The MS/MSD is an important aspect of an overall quality assurance program for a project. When soil sampling, a MS/MSD sample should be collected for each analytical method at a frequency of five (5) percent of the field samples, unless otherwise specified in the site-specific QAPP. The MS/MSD sample should be prepared in a fashion similar to the other samples. Samples taken for MS/MSD should be labeled as such and specified on the chain-of-custody form. The primary purpose of MS/MSD analyses is to establish the applicability of the overall analytical approach to the specific sample matrix from the site.

Each sample set designated for MS/MSD analysis should be collected in triplicate (e.g., if using En Core® Samplers, then nine 5-gram sample containers would be required).

3.5.4 Other Field Quality Control Samples

Field quality control samples to demonstrate the integrity of the field samples should also be collected as required by the site-specific QAPP. Field duplicates should be collected at a minimum frequency of 10 percent of the samples. Field blanks and equipment rinsate blanks, if required, should be collected each day, or as specified in the site-specific QAPP.

4.0 REQUIRED DOCUMENTATION

The following records generated as a result of implementation of this procedure must be maintained as quality records.

- GPS or survey coordinates for each sample location
- Chains of Custody
- Sample collection logs, including recorded weights of samples placed in vials.
- Field notes

5.0 ATTACHMENTS

Attachment A. Limitations to VOC Soil Sampling Procedures
Attachment B. Various Options for the Collection of Soil Samples for VOC Analyses

6.0 FORMS

None.

7.0 REFERENCES

California Environmental Protection Agency, Department of Toxic Substances Control (DTSC), 2004. *Guidance Document for the Implementation of USEPA Method 5035: Methodologies for Collection, Preservation, Storage, and Preparation of Soils to be Analyzed for Volatile Organic Compounds*. November.

United States Department of Defense (USDoD), 2013. *Quality Systems Manual, Version 5.0* July.

United States Environmental Protection Agency (USEPA), Office of Solid Waste, 1997. *Method 5035, Closed-System Purge-and-Trap Extraction for Volatile Organics in Soil and Waste Samples.* June. Part of methods compendium SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Update III* (Method 5035).

USEPA, Office of Solid Waste, 2002. *Method 5035A, Closed-System Purge-and-Trap Extraction for Volatile Organics in Soil and Waste Samples.* July. Part of methods compendium SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Update III* (Method 5035). Updated method.

ATTACHMENT A. LIMITATIONS TO VOC SOIL SAMPLING PROCEDURES

Each of the sampling and preservation procedures has their own set of benefits and limitations. Selection of the appropriate procedure should be based primarily on which procedure best addresses the data quality objectives (DQOs) while considering the limitations imposed by field conditions and sampling requirements. Some of the limitations of the different procedures include:

- Multi-Functional Sampling Devices. When the MFSDs are received by the laboratory, the soil subcores within the MFSDs are extruded into VOA vials for analysis. As the soil subcores pass from the MFSDs to the VOA vials during the extrusion process, the soil subcores are open to ambient air and VOC loss could occur. This VOC loss could yield analytical results that are potentially biased low. Users of MFSDs must recognize this limitation when evaluating the data quality objectives for their project.
- Field Chemical Preservation. Chemical preservation of VOA vials in the field with sodium bisulfate solution (low-level analysis) or methanol (high-level analysis) is considered to yield better representativeness for VOC analysis of soil. The introduction of chemical preservatives in the field inhibits VOC loss by biodegradation. Also, VOC loss due to sample handling at the laboratory is minimized in that the sample aliquot is placed in a VOA vial in the field that contains the required preservative, sodium bisulfate or methanol, and stir stick and therefore each VOA vial does not need to be reopened by the laboratory as syringes may be used through the septum cap. However, field preservation has significant limitations that may ultimately prohibit its use on some sites. One issue is that storage of methanol used in preservation may absorb non-site specific VOCs during storage and transport. When the concentration levels of VOCs are not known to be low or high (above 200 ug/kg), multiple VOCs vials containing sodium bisulfate, methanol, and no preservative, will need to be processed in the field for each sample location.
- Empty Vial Technique. The extractant fluid, whether methanol, sodium bisulfate solution, or reagent water, must be added by the stationary laboratory to the VOA vials after the soil has been sealed into the vials in the field. To do this, the PTFE-lined septum caps must be pierced for the introduction of the extraction fluid into the VOA vials. After the introduction of the extraction fluid, the vials must be stirred or sonicated to promote the partitioning of the VOCs into the extraction fluid. Upon completion of the stirring or sonication, the sample is then analyzed for VOC concentration. During the stirring or sonication, VOCs can escape from the VOA vial through the pierced septum. Hence, the Empty Vial Technique may potentially yield analytical results that are biased low. Users of the Empty Vial Technique must recognize this limitation when evaluating the data quality objectives for their project.

ATTACHMENT B. VARIOUS OPTIONS FOR THE COLLECTION OF SOIL SAMPLES FOR VOC ANALYSES

Option	Sample Collection	Sample Container	Field Preservation	Laboratory Procedure	Holding Time (DTSC/EPA)	Reporting Limt
3.1(a)1	MFSD[(1)]	MFSD	Cool to 4 ± 2°C	Analyze w/in 48 hrs of sample collection	48 hours	Low/High
3.1(a)2	MFSD	MFSD	Cool to 4 ± 2°C	Extrude sample w/in 48 hrs into unpreserved VOA and freeze to < 7°C	7 days / 14 days	Low/High
3.1(a)3	MFSD	MFSD	Cool to 4 ± 2°C	Extrude sample w/in 48 hrs into methanol preserved VOA and cool to 4±2°C	14 days	High
3.1(a)3	MFSD	MFSD	Cool to 4 ± 2°C	Extrude sample w/in 48 hrs into sodium bisulfate preserved VOA and cool to 4±2°C	14 days	Low/High
3.1(a)3	MFSD	MFSD	Cool to 4 ± 2°C	Extrude sample w/in 48 hrs into reagent-grade extractant water VOA and cool to 4±2°C	14 days	Low/High
3.1(b)	MFSD	MFSD	Freeze to < 7°C	Use of any of the above laboratory procedures and associated holding times	—[(3)] / See above	See above
3.2(a)	SCD	VOA	Preserve with methanol and cool to 4 ± 2°C	Cool sample to 4±2°C	14 days	High
3.2(b)	SCD	VOA	Preserve with sodium bisulfate and cool to 4 ± 2°C	Cool sample to 4±2°C	14 days	Low/High
3.2(c)	SCD	VOA	Extract into reagent-grade water and cool to 4 ± 2°C	Analyze w/in 48 hrs of sample collection	48 hours	Low/High
3.2(d)	SCD	VOA	Extract into reagent-grade water and freeze to < 7°C	Freeze sample to < 7°C	7 days / 14 days	Low/High
3.2(e)	SCD	VOA	Extract into reagent-grade water and cool to 4 ± 2°C	Freeze sample w/in 48 hrs to < 7°C	7 days / 14 days	Low/High
3.3(a)	SCD	VOA	Cool to 4 ± 2°C	Cool to 4±2°C	48 hours	Low/High
3.3(b)	SCD	VOA	Cool to 4 ± 2°C	Freeze sample w/in 48 hrs to < 7°C	14 days	Low/High
3.3(c)	SCD	VOA	Cool to 4 ± 2°C	Extrude sample w/in 48 hrs into methanol preserved VOA and cool to 4±2°C	14 days	High
3.3(d)	SCD	VOA	Freeze to < 7°C	Freeze to < 7°C	14 days	Low/High

(1) Multi-Function Sampling Device (e.g., EnCore Sampler).
(2) Sub-Coring Device (e.g., Lock N' Load sampling system)
(3) Freezing of MFSDs are not recommended by DTSC due to the potential for damage to their seals.

Standard Operating Procedure

Groundwater: Low-Flow Sampling from Ground Water Monitoring Wells

PR-TC-02.02.02.03 v2.1

Reviewed by: ______________________ Date: 24 Jan 2014
Mark Blaisdell, Project Geologist

Reviewed by: ______________________ Date: 24 Jan 2014
Pete Phillips, Senior Geologist

Approved by: ______________________ Date: 24 Jan 2014
Jeffrey Hess, Director Technical Services

Review / Revision History:

Version	Changes	Affects Section/Pages	Effective Date	Approval*
1.0	Initial Issue		08 Apr 2010	NA
1.1	Updated stabilization criteria to add temperature as a "monitored" criteria	Section 3.1, pg. 3 Section 3.2, pg. 6	01 Jul 2010	JH
2.0	Updated procedure and added definitions	All	24 Jan 2014	NA
2.1	Updated organization name. No other changes needed.	All	6 Aug 2014	J. Hess

* Approval required for reviews and minor changes only. Substantive revisions to the technical requirements contained in the SOP require review and approval by the signatures to the SOP.

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Table of Contents

1.0 PURPOSE AND SCOPE

The purpose of this standard operating procedure is to describe the requirements and procedures for the collection of representative samples from ground water. It includes samples collected from either temporarily or permanently installed ground water monitoring wells using a low-stress, low-flow purging and sampling technique consistent with accepted EPA procedures outlined in *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*, EPA/540/S-95/504, dated April 1996.

Note: The procedure outlined in this SOP requires the use of: 1) a portable or dedicated pump; and 2) sufficient yield from the well during purging to maintain a relatively constant flow without causing undue stress (significant drawdown) on the groundwater. For wells with very poor yield, or where pumps can't be used, alternate sampling techniques should be employed.

2.0 ACRONYMS AND DEFINITIONS

For purposes of this procedure, a number of terms and acronyms are defined below.

Low-Flow:	A flow rate on the order of 0.1 to 0.5 liters per minute (L/min) (0.03 to 0.13 gallons per minute [g/min]), resulting in a drawdown of less than 0.1 meters [m] (0.33 feet) during purging.
Drawdown:	The difference between the stable height of water in the well prior to pumping and the height of water in the well during pumping.
DO:	dissolved oxygen
EC:	electrical conductivity
Flow-through cell:	device used with a water quality meter to measure water quality indicator parameters under pumping conditions and without air exposure
FSP:	field sampling plan
mg/L:	milligrams per liter
mv:	millivolt
NTU:	nephelometric turbidity unit
OVM:	organic vapor meter
ORP:	oxidation-reduction potential
PID:	photoionization detector used to measure organic vapor
QA:	quality assurance
QAPP:	quality assurance project plan
QC:	quality control
Redox:	oxidation-reduction
SAP:	sampling and analysis plan
uS/cm:	micro-Siemens per centimeter (equivalent to micromhos per centimeter [umhos/cm])

Turbidity meter: device used to measure nephelometric turbidity units

VOA: volatile organic analysis

VOC: volatile organic compound

3.0 PROCEDURES

The intent of this procedure for the low-flow sampling technique is to collect representative groundwater samples with minimal interference to sample integrity from using a pump. The terms "discharge" and "flow" are used interchangeably in this SOP.

3.1 PURGING AND SAMPLING PROCEDURES – DEDICATED PUMPS

Pre-Sampling Activities

1. Sampling should begin at the monitoring well with the lowest levels of contamination, generally upgradient or at the furthest distance from the site or suspected source. Sampling should then proceed systematically to the monitoring wells with the highest levels of contaminated ground water.
2. Check and record the condition of the monitoring wellhead for damage or evidence of tampering. Lay polyethylene sheeting next to the wellhead to minimize the likelihood of contamination of sampling/purging equipment from the ground surface. Place clean (decontaminated) monitoring, purging and sampling equipment on the sheeting.
3. Unlock wellhead. Record location, time, date and appropriate information in a field notes or on the groundwater purge and sample form (see the attached Low-Flow Groundwater Purge and Sample Log form).
4. Remove well casing cap.
5. Monitor the headspace of the well at the rim of the casing for organic vapors with a photoionization detector (PID), if appropriate for the site, and record measurements in the field notes or on the groundwater purge and sample form.
6. Measure the depth to water (water level must be measured to nearest 0.01 feet) relative to a reference measuring point on the well casing with an electronic water level indicator (see SOP PR-TC-02.03.09.00). If no reference point is found, measure the depth to water relative to the top of north side of the inner well casing, mark that reference point on the outside of the well casing and note that reference point in the field notes. Record information on depth to ground water in the field notes or on the groundwater purge and sample form. Record a second measurement of the depth to water to confirm the initial measurement; measurements should agree to within 0.02 feet or re-measure until the measured depth to groundwater is stable.
7. Check the available well information or field information for the total depth of the monitoring well. Use the information from the measured depth to water and the total depth of the monitoring well to calculate the volume of water in the monitoring well casing. Record the calculated volume of water in the well casing in the field notes or on the groundwater purge and sample form.

Purging and Sampling Activities

8. Refer to the available monitoring well information and record the depth of the pump intake in the field notes or on the low-flow groundwater purge and sample form.

9. If purging and sampling activities are not performed immediately following the pre-sampling activities (i.e., depth to water was measured for multiple wells at one time, followed later by initiation of sampling efforts), then re-measure the water level (water level must be measured to nearest 0.01 feet). Record the depth to water in the well casing on the groundwater-sampling log immediately before purging. Leave the water level indicator probe in the monitoring well during purging and sampling.

10. Connect one end of clean sample tubing to the pump discharge line and the other end to a flow-through cell (used to measure water quality indicator parameters discussed below). A "T" connection may need to be installed in the sample tubing between the pump discharge line and the flow-through cell for the collection of water for turbidity measurements (if the flow-through cell does not include turbidity measurement). The sample tubing from the flow-through cell must be directed into a container to store water during purging and sampling activities.

11. Start pumping the well at a low flow rate of about 0.1 liter per minute [L/min] or about 0.03 gallons per minute [g/min]) and slowly increase the rate. Measure the drawdown continuously during the flow rate increase. Maintain a steady flow rate while maintaining a drawdown of less than 0.1 m or about 0.33 feet. If drawdown is greater than 0.1 m or 0.33 feet, lower the flow rate until drawdown is at or less than 0.1 m or 0.33 feet. It should be noted that this goal may be difficult to achieve under some site conditions, and may require some deviation from the recommended flow rates based on site-specific conditions. If adjustments are made to the degree that acceptable drawdown conditions are met, note the nature of the adjustments that were made in the field notes.

12. Measure the pump discharge rate with a graduated cylinder or similar container of known volume. Measure the water level in the well casing and record pump discharge rate and water level in the field notes or on the groundwater purge and sample form. Continue purging and recording water level and pump discharge rate every three to five minutes during purging. Pumping rates should be kept at minimal flow to ensure minimal drawdown in the monitoring well.

13. During purging, a minimum of one sample tubing and pump discharge line volume (including the volume of water in the pump and flow cell) must be purged prior to recording the initial water-quality indicator parameters (discussed below). When that volume of water has been purged from the well, monitor and record the water-quality indicator parameters every three to five minutes from the flow-through cell. The water-quality indicator field parameters are temperature, pH, electrical conductivity, dissolved oxygen, oxidation-reduction (Redox) potential and turbidity. Oxidation-reduction potential is used for both assessing Redox conditions and as a real-time check of the dissolved oxygen readings. Purging will continue until the discharged water reaches a specified set of stable water-quality indicator parameter measurements. Purged water is considered stable when three successive readings of the water quality indicator parameters have been recorded. The following criteria must be met to establish stabilization:

Parameter	Stabilization Criteria
Temperature	monitored, but not a stabilization criteria
pH[(1)]	± 0.2 pH units
Electrical conductivity[(1)] (EC)	± 10% of the reading
Dissolved oxygen[(1)] (DO)	± 10% of the reading, or ± 0.3 mg/L, whichever is greater
Oxidation-reduction potential (ORP)	monitored, but not a stabilization criteria
Turbidity	<10 NTU if possible, or ± 10% of the reading if ≥ 10 NTU

[(1)] A minimum of the three indicated parameters should reach stabilization prior to sampling.

14. Once the criteria have been successfully met indicating that the water quality parameters have stabilized, sample collection can take place.

15. If stabilized drawdown in the well cannot be maintained at less than 0.1 m or 0.33 feet and the water level is approaching the top of the screened interval, reduce the flow rate or turn the pump off for a period of at least 15 minutes and allow groundwater in the well to recover. (NOTE: the pump must be equipped with a check valve if the pump is shut off) Under no circumstances should the well be pumped dry. After allowing groundwater in the well casing to recharge, begin pumping at a lower flow rate, if the water draws-down to the top of the screened interval again, turn the pump off and follow the recovery process again. If two sample tubing and pump discharge line volumes (including the volume of water in the pump and flow-through cell) have been removed during purging, then sampling can proceed the next time the pump is turned on. This information should be noted in the field notes and groundwater purge and sample form including a recommendation for use of a different purging and sampling procedure for the well.

16. Maintain the same pumping rate or reduce slightly for sampling (0.1 to 0.4 L/min or 0.03 to 0.11 g/min) in order to minimize disturbance of the water column. Samples should be collected directly from the discharge port of the pump sample tubing prior to passing through the flow-through cell (disconnect the sample tubing from the flow-through-cell prior to sample collection). The sample tubing must be completely full of ground water when collecting samples for dissolved gases or VOCs to prevent aeration as the ground water flows through the discharge line.

17. In the event that ground water is too turbid (greater than 10 NTUs), or as otherwise required in the project-specific SAP or FSP/QAPP for metal sample collection, a filtered metal (dissolved) sample should be collected. Filtered metal samples should be collected using an appropriately sized (typically 0.45 micron) in-line filter fitted to the end of the sample tubing. Filtered samples should be collected directly from the in-line filter discharge line. <u>Laboratory filtering should be avoided</u> due to significant potential changes in sample geochemistry and resulting effects on total and dissolved-phase metals.

18. Disconnect the sample tubing that extends from the wellhead (or cap) and properly dispose after use.

19. Replace the well cap, close and lock the wellhead.

3.2 PURGING AND SAMPLING PROCEDURES – PORTABLE PUMPS

Pre-Sampling Activities

1. Sampling should begin at the monitoring well with the lowest levels of contamination, generally upgradient or at the furthest distance from the site or suspected source. Sampling should then proceed systematically to the monitoring wells with the highest levels of contaminated ground water. The portable pump should be fully decontaminated to site-specific requirements prior to sampling each well.
2. Check and record the condition of the monitoring wellhead for damage or evidence of tampering. Lay polyethylene sheeting next to the wellhead to minimize the likelihood of contamination of sampling/purging equipment from the ground surface. Place clean (decontaminated) monitoring, purging and sampling equipment on the sheeting.
3. Unlock wellhead. Record location, time, date and appropriate information in a field notes or on the groundwater purge and sample form (see the attached Low-Flow Groundwater Purge and Sample Log form).
4. Remove well casing cap.
5. Monitor the headspace of the well at the rim of the casing for organic vapors with a photoionization detector (PID), if appropriate for the site, and record measurements in the field enots or on the groundwater purge and sample form.
6. Measure the depth to water (water level must be measured to nearest 0.01 feet) relative to a reference measuring point on the well casing with an electronic water level indicator (see SOP PR-TC-02.03.09.00). If no reference point is found, measure the depth to water relative to the top of north side of the inner well casing, mark that reference point on the outside of the well casing and note that reference point in the field notes. Record information on depth to ground water in the field notes or on the groundwater purge and sample form. Record a second measurement of the depth to water to confirm the initial measurement; measurements should agree to within 0.02 feet or re-measure until the measured depth to groundwater is stable.
7. Check the available well information or field information for the total depth of the monitoring well. Use the information from the measured depth to water and the total depth of the monitoring well to calculate the volume of water in the monitoring well casing. Record the calculated volume of water in the well casing in the field notes or on the groundwater purge and sample form.

Purging and Sampling Activities

8. Refer to the available monitoring well information to determine the depth and length of the screen interval. Place the pump and support equipment at the wellhead and slowly lower the pump and discharge line down into the monitoring well until the pump intake is set in the middle of the screened interval. Do not touch bottom with the bottom of the pump and measure up as this has the potential to greatly increase initial turbidity. The pump position should be set with a calibrated pump discharge line or a weighted-measuring tape. To reduce the potential for disturbing sediments and other debris that

typically accumulate at the bottom of the well, do not lower the pump to the bottom of the screen/well. Record pump depth in field notes or on the groundwater purge and sample form.

9. Measure the water level (water level must be measured to nearest 0.01 feet) and record information in the field notes or on the groundwater purge and sample form. Leave the water level indicator probe in the monitoring well.

10. Connect one end of clean sample tubing to the pump discharge line and the other end to a flow-through cell (used to measure water quality indicator parameters discussed below). A "T" connection may need to be installed in the sample tubing between the pump discharge line and the flow-through cell for the collection of water for turbidity measurements (if the flow-through cell does not include turbidity measurement). The sample tubing from the flow-through cell must be directed into a container to store water during purging and sampling activities.

11. Start pumping the well at a low flow rate (about 0.1 L/min or 0.03 g/min) and slowly increase the rate. Measure the drawdown continuously during the flow rate increase. Maintain a steady flow rate while maintaining a drawdown of less than 0.33 feet from the initial static water level obtained in Step 6. (Note that the act of placing the pump will cause a temporary water level rise from displacement. Do not use this new level as the start point for drawdown.) If drawdown is greater than 0.1 m or 0.33 feet, lower the flow rate until drawdown is at or less than 0.1 m or 0.33 feet. It should be noted that this goal may be difficult to achieve under some site conditions, and may require some deviation from the recommended flow rates based on site-specific conditions. If adjustments are made to the degree that acceptable drawdown conditions are met, note the nature of the adjustments that were made in the field notes.

12. Measure the pump discharge rate with a graduated cylinder or similar container of known volume. Measure the water level in the well casing and record pump discharge rate and water level in the field notes or on the groundwater purge and sample form. Continue purging and recording water level and pump discharge rate every three to five minutes during purging. Pumping rates should be kept at minimal flow to ensure minimal drawdown in the monitoring well.

13. During purging, a minimum of one sample tubing and pump discharge line volume (including the volume of water in the pump and flow cell) must be purged prior to recording the initial water-quality indicator parameters (discussed below). When that volume of water has been purged from the well, monitor and record the water-quality indicator parameters every three to five minutes from the flow-through cell. The water-quality indicator field parameters are temperature, pH, electrical conductivity, dissolved oxygen, oxidation-reduction (Redox) potential and turbidity. Oxidation-reduction potential is used for both assessing Redox conditions and as a real-time check of the dissolved oxygen readings. Purging will continue until the discharged water reaches a specified set of stable water-quality indicator parameter measurements. Purged water is considered stable when three successive readings of the water quality indicator parameters have been recorded. The following criteria must be met to establish stabilization:

Parameter	Stabilization Criteria
Temperature	monitored, but not a stabilization criteria
pH[1]	± 0.2 pH units
Electrical conductivity[1] (EC)	± 10% of the reading
Dissolved oxygen[1] (DO)	± 10% of the reading, or ± 0.3 mg/L, whichever is greater
Oxidation-reduction potential (ORP)	monitored, but not a stabilization criteria
Turbidity	<10 NTU if possible, or ± 10% of the reading if ≥ 10 NTU

[1] A minimum of the three indicated parameters should reach stabilization prior to sampling.

14. Once the criteria have been successfully met indicating that the water quality parameters have stabilized, sample collection can take place.

15. If stabilized drawdown in the well cannot be maintained at less than 0.33 feet and the water level is approaching the top of the screened interval, reduce the flow rate or turn the pump off for a period of at least15 minutes and allow groundwater in the well to recover. (NOTE: the pump must be equipped with a check valve if the pump is shut off) Under no circumstances should the well be pumped dry. After allowing groundwater in the well casing to recharge, begin pumping at a lower flow rate, if the water draws-down to the top of the screened interval again turn the pump off and follow the recovery process again. If two sample tubing and pump discharge line volumes (including the volume of water in the pump and flow-through cell) have been removed during purging, then sampling can proceed the next time the pump is turned on. This information should be noted in the field notes and groundwater purge and sample form including a recommendation for use of a different purging and sampling procedure for the well.

16. Maintain the same pumping rate or reduce slightly for sampling (0.1 to 0.4 L/min or 0.03 to 0.11 g/min) in order to minimize disturbance of the water column. Samples should be collected directly from the discharge port of the pump sample tubing prior to passing through the flow-through cell (disconnect the sample tubing from the flow-through-cell prior to sample collection). The sample tubing must be completely full of ground water when collecting samples for dissolved gases or VOCs to prevent aeration as the ground water flows through the discharge line.

17. In the event that ground water is too turbid (greater than 10 NTUs), or as otherwise required in the project-specific SAP or FSP/QAPP for sample collection, a filtered metal (dissolved) sample should be collected. Filtered metal samples should be collected using an appropriately sized (typically 0.45 micron) in-line filter fitted to the end of the sample tubing. Filtered samples should be collected directly from the in-line filter discharge line. Laboratory filtering should be avoided due to significant potential changes in sample geochemistry and resulting effects on total and dissolved-phase metals.

18. Disconnect the sample tubing that extends from the wellhead (or cap) and properly dispose after use.

19. Replace the well cap, close and lock the wellhead.

3.3 EQUIPMENT

The following equipment is required for this procedure:

- Electronic depth to water meter (Water level meter)
- Dedicated or portable submersible pump capable of attaining low flow discharge rates (typically bladder or electrical pumps constructed of inert materials [such as stainless steel and Teflon], but can include other types including peristaltic for shallow groundwater conditions)
- Dedicated or disposable sample tubing
- Disposable bladders, as needed.
- Calibrated water quality parameter meter with flow-through cell (YSI 556 or equivalent)
- Turbidity Meter (EXTECH TB400 or equivalent)
- Flow measuring device (typically graduated cylinder)
- Appropriate sample containers
- Lab quality in-line disposable filter, as needed (typically 0.45 micron)
- Container for purge water (typically 55-gallon UN-approved drum)
- Plastic sheeting
- Disposable gloves
- GPS unit (if coordinates for the wells are not already known)
- Notebook and/or appropriate field forms

3.4 SAMPLE COLLECTION

This section discusses specific issues and concerns relating to the physical collection of groundwater samples from the discharge of the low-flow sampling system.

- Sample containers should be filled with minimal turbulence by allowing the ground water to flow from the sample tubing at as low a velocity as possible, down the inside of the container.
- Sample containers should be filled in the following sequence: volatile organics (VOCs, BTEX), semivolatile organics (SVOCs, extractable fuels), and inorganics.
- When filling the VOC sample vials, a meniscus must be formed over the mouth of the vial to eliminate the formation of air bubbles and headspace prior to capping. Once the VOA vial is filled and capped, invert the sample and tap gently on the side of the vial to insure that the vial does not contain entrapped air. If any entrapped air is present, empty the sample in the purge water container, discard the vial and collect a sample in a new VOA vial.
- In the event that total metals samples are scheduled to be collected and the ground water is turbid (greater than 10 NTUs), or as otherwise required in the project-specific SAP or FSP/QAPP, a filtered metal (dissolved) sample also should be collected. Filtered samples

should be collected last, as they require placement of an in-line field filter on the sample tubing. To collect the filtered sample, attach an appropriately sized in-line filter to the end of the sample tubing, and collect the sample from the filter effluent port. Typically, a 0.45-micron filter can be used; however, the filter size may vary depending on project specific conditions. Refer to the site-specific FSP for correct filter selection.

3.5 QC SAMPLING

Quality control (QC) samples must be collected to verify that sample collection and handling procedures were performed appropriately and that they have not compromised the quality of the ground water samples. The applicable EPA program guidance must be consulted in preparing the field QC sample requirements for each site-specific Quality Assurance Project Plan (QAPP). There are five primary areas of concern for quality assurance (QA) in the collection of representative ground-water samples:

1. Obtaining a ground-water sample that is representative of the aquifer or zone of interest in the aquifer. Quality assurance is verified based on field log documentation of the field water-quality parameter stabilization during well purging, prior to sample collection.
2. Ensuring that the purging and sampling equipment are made of materials, and utilized in a manner, which will not interact with or alter the analyses.
3. Ensuring that results generated by these procedures are reproducible; therefore, the sampling scheme should incorporate co-located samples (duplicates).
4. Preventing cross-contamination. Sampling should proceed from wells with the lowest to highest levels of contamination, if known. Field equipment blanks should be incorporated for all sampling and purging equipment that is used on more than one well, and decontamination of such equipment is therefore required.
5. Properly preserving, packaging, and shipping samples.

All field QC samples must be prepared using the same methods as the investigation samples with regard to sample volume, containers, and preservation. The chain of custody procedures for the QC samples must be identical to the investigation ground water samples. Equipment blanks listed below are to be collected from non-dedicated pieces of equipment that require decontamination between wells, such as a non-dedicated bladder pump. The following QC samples must be collected during the sampling event:

Sample Type	Suggested Frequency
Field duplicates	1 per 20 samples
Matrix spike	1 per 20 samples
Matrix spike duplicate	1 per 20 samples
Equipment blank	1 per day per piece of equipment
Trip blank (VOCs)	1 per sample cooler
Temperature blank	1 per sample cooler

4.0 REQUIRED DOCUMENTATION

The following records must be generated and maintained as a result of implementation of this procedure as quality records.

- Low-flow groundwater purges and sample forms.
- Field notes.
- Chains of Custody.

5.0 ATTACHMENTS

None.

6.0 FORMS

Low-Flow Groundwater Purge and Sample Form.

7.0 REFERENCES

ASTM, 2002. *Standard Practice for Low-Flow Purging and Sampling*.

USEPA, 2002. *Ground-Water Sampling Guidelines for Superfund and RCRA Managers*.

U.S. Environmental Protection Agency (USEPA), 1996. *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*, EPA/540/S-95/504. April.

USEPA, 1987. *Compendium of Superfund Field Operations*.

Forms

Low-Flow Groundwater Purge and Sample Log

Project Name: ______________________ Project No.: ______________

Well No./ Location ID: ____________ Tested By: ____________ Date: ____________

Measuring Point Description: ______________________ Static Water Level (ft.): ________

Total Well Depth (ft.): ________ Screen Interval (ft.): ________ Sample Depth (ft.): ________

Water Level Measurement Method: ______________________

Purge Method: ______________ Sample Method: ______________

Time Start Purge: ______________ Field Filter (micron): 1.0 / 0.45 / 0.1 / Other:

Time End Purge: ______________ Time Sampled: ______________

Volume Purged (L): ______________ Calculated Flow Rate (L/min): ______________

Sample ID: ______________________

Comments: ______________________

Time	Temp. (ºC)	pH	EC (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	DTW (ft.)

Version 012314

Standard Operating Procedure

Groundwater: Measuring Water Levels

PR-TC-02.03.09.00 v1.2

Reviewed by: ______________________ Date: 3 Feb 2010
Jim Schollard, QA Manager

Approved by: ______________________ Date: 16 Feb 2010
Jeffrey Hess, Director Technical Services

Review / Revision History:

Version	Changes	Affects Section/Pages	Effective Date	Approval*
1.0	Initial Issue	NA	16 Feb 2010	NA
1.1	Remove reference to decontamination SOP currently under revision.	Pgs 3-4	05 Aug 2010	J Hess
1.2	Updated organization name. No other changes needed.	All	6 Aug 2014	JHess

* Approval required for reviews and minor changes only. Substantive revisions to the technical requirements contained in the SOP require review and approval by the signatures to the SOP.

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Table of Contents

1.0 PURPOSE AND SCOPE

The purpose of this standard operating procedure is to describe the requirements and procedures for measurement of groundwater well water levels and for conducting measurements of light non-aqueous phase liquids (LNAPLs).

2.0 ACRONYMS AND DEFINITIONS

For purposes of this procedure, a number of terms and acronyms have the meanings defined below.

DTB: Depth to Bottom

DTW: Depth to Water

Electronic sounder: Commercial battery-powered water level measuring device that includes a graduated cable secured to a reel with a probe sensor at the cable terminus that is designed to register a signal when the probe contacts water. The cable must have graduations to 0.01 feet.

Field logbook: Logbooks used at field sites that contain detailed information regarding site activities including dates, times, personnel names, activities conducted, equipment used, weather conditions, etc. Field logbooks are used by a variety of different field personnel and are part of the project file.

Light non-aqueous phase liquid (LNAPL): Free-phase petroleum hydrocarbons in groundwater.

Non-aqueous phase liquid (NAPL): Free-phase liquid in groundwater.

Measuring tape: Steel or plastic tape with graduations to 0.01 feet.

Oil/water interface probe: Commercial probe and cable designed to register a signal when the probe contacts oil and a different signal when the probe contacts water. The cable must have graduations to 0.01 feet.

Pressure Transducer: A commercial batter-powered electronic device to measure changes in pressure of a column of water column. Typically used to measure changes in water level over time.

3.0 PROCEDURES

The intent of this sampling technique is to collect reliable water level depths in monitoring wells and other groundwater monitoring points, and to evaluate the potential presence and thickness of LNAPL.

3.1 MEASURING WATER LEVELS WITH AN ELECTRONIC SOUNDER

The standard equipment for collecting individual water-level measurements will be a battery-powered sounder.

Calibration checks on the electronic sounder will be made annually and the date of calibration recorded on the device. The sounder markings will first be checked for the proper spacing by physically comparing the spacing with a graduated steel tape. These checks will be made annually and after any incident that may alter the measuring capability of the instrument, such as cable stretching, entanglement, or sensor tip replacement.

The following procedure should be used when measuring groundwater levels with an electronic water-level measuring device:

1. Where historic water quality results are available, the monitoring wells should generally be measured in the order of clean to dirty.
2. Check for proper instrument response by inserting the sensor at the end of the cable, the "probe", in water. Fix or replace the probe or instrument if the instrument operates intermittently or is non-responsive.
3. Unlock the well cover and remove the cap.
4. Locate the reference point on the riser pipe (this is generally either a black line or notch in the casing, and is generally located on the north side of the casing).
5. Don a pair of clean gloves.
6. Slowly lower the probe down the well until the signal indicates that the water has been contacted.
7. Note the reading at the depth corresponding to the reference point on the riser pipe.
8. Withdraw the probe; then repeat steps 5 and 6. [NOTE: If free-phase hydrocarbons are suspected or observed on the probe, measurement of hydrocarbon thickness and water level should be made using an electronic oil/water interface probe. See Section 3.2.] Consecutive measurements should agree within 0.02 feet. If not, continue with measurements until 0.02 feet precision is achieved. Record the reading to the nearest 0.01 feet in the field logbook or on the field form as **Depth to Water** (DTW) and note the measurement is final.
9. To verify the well identification by confirming the total depth of the well, or if groundwater sampling will be conducted, then lower the probe until the bottom of the well is reached, as indicated by slack in the line.

10. Pull slightly to remove the slack, measure at the reference point, and record this value to the nearest 0.01 feet in the field logbook or on the field form as **Depth to Bottom** (DTB).

11. Remove the probe from the well and decontaminate the probe and all portions of the cable that were inserted in the well. Sounders will be maintained in a clean and functional condition.

3.2 MEASURING WATER LEVELS AND LIGHT NON-AQUEOUS PHASE LIQUIDS USING AN OIL/WATER INTERFACE PROBE

Oil or other light non-aqueous phase liquids (LNAPLs) may be floating on the water in some wells. In such instances, the LNAPL level and the water level are measured using an oil/water interface probe, as follows:

1. Check for proper instrument response by inserting the probe in water. Electronic Sounders typically indicate the presence of LNAPLs with a steady indicator light and tone, while the presence of water is indicated by an intermittent light and tone.

2. Unlock the well cover and remove the cap.

3. Locate the reference point on the riser pipe.

4. Don a pair of clean gloves.

5. Slowly lower the oil/water interface probe down the well until the signal indicates that LNAPL has been contacted (typically a steady indicator light and tone).

6. Record the reading at the reference point to the nearest 0.01 feet in the field logbook or on the field form as depth to **non-aqueous phase liquid** (NAPL).

7. Continue lowering the probe until the signal indicates that water has been contacted (typically an intermittent light and tone).

8. Record the reading at the reference point to the nearest 0.01 feet in the field logbook or on the field form as DTW.

9. Withdraw the probe and repeat steps 5 through 8. Duplicate measurements should agree within 0.02 feet. If not, continue with measurements until 0.02 feet precision is achieved. Record the readings to the nearest 0.01 feet in the field logbook or on the field form as final readings.

10. To verify the well identification by confirming the total depth of the well, or if groundwater sampling will be conducted, lower the probe until the bottom of the well is reached, as indicated by slack in the line.

11. Pull slightly to remove the slack, measure at the reference point, and record it as DTB.

12. Remove the probe from the well and decontaminate the probe and all portions of the cable that were inserted in the well. Sounders will be maintained in a clean and functional condition. Special care should be taken to decontaminate the oil/water interface probe.

3.3 MEASURING WATER LEVELS USING A PRESSURE TRANSDUCER

Electronic pressure transducers may be used during aquifer testing, tidal studies, or other studies where frequent or continuous measurement of water levels over time is needed.

Pressure transducers will be operated, calibrated, maintained, and stored in accordance with the manufacturer's specifications and the following guidelines:

1. The depth to water in the well will be measured with an electronic sounder at the time of transducer placement and immediately prior to transducer removal from the well to verify accuracy, and will be recorded in the field logbook or on the appropriate field form(s).
2. The transducer calibration will be checked in the field by lowering it exactly one (1) foot in the water column and noting the change in the meter response. Results of the calibration check and conditions that could affect transducer operation will be noted and recorded in the field logbook.
3. When pressure transducers are used for continuous water-level monitoring over extended periods of time, the calibration of the transducer will be checked periodically by measuring the water level with an electronic sounder.

3.4 EQUIPMENT

The following items are required for this procedure:

- Decontaminated, commercial electronic sounder, such as a *Solinst Model 101 Water Level Meter* or equivalent.
- Oil/water interface probe (if measuring LNAPL), such as *Solinst Model 122 Interface Meter* or equivalent.
- Field logbook or appropriate field form for recording measurements and calibration activities.
- Personal protective equipment (PPE) as specified in the site-specific Health and Safety Plan (SSHSP).

3.5 QC SAMPLING

Redundant measurements are specified for each step in the above procedures, both to ensure accurate readings and to determine the stability of the groundwater level. If consistent stable groundwater levels cannot be achieved, make special note of this in the field documentation, including whether the level is consistently rising, dropping, or fluctuating.

4.0 REQUIRED DOCUMENTATION

The following records generated as a result of implementation of this procedure must be maintained as quality records.

- Field notes reported in either the field logbook or on the appropriate field forms(s).

5.0 ATTACHMENTS

None.

6.0 FORMS

- Monitoring Well Water Level Measurement Form

7.0 REFERENCES

American Society for Testing and Materials (ASTM), D4750-87 (Reapproved 2001), *Standard Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well)*, West Conshohocken, PA.

U.S. Department of the Interior, 1977 (updated 1984), *National Handbook of Recommended Methods for Water-Data Acquisition*, Chapter 2, Reston, VA.

Forms

Monitoring Well Water Level Measurement Form

Gilbane

Project Name:	Page of
Project No./Task Code:	Date:
Measured By:	

Monitoring Well I.D.	Depth to NAPL (feet)	Depth to Water (feet)	Depth to Bottom (feet)	Time	Comments/ Observations

Additional Comments:

Prepared by:	Signature:

Standard Operating Procedure

Sample Handling, Packaging and Shipping

PR-TC-02.04.01.01 v2.1

Prepared by: Kristen Carlyon, Program Chemist — Date: 13 June 2013

Reviewed by: Jim Schollard, Program QA/QC Manager — Date: 13 June 2013

Approved by: Jeffrey Hess, Director Technical Services — Date: 13 June 2013

Review / Revision History:

Version	Changes	Affects Section/Pages	Effective Date	Approval
1.0	Initial Issue	NA	30 Sep 2009	NA
1.1	Added perchlorate to the Sample Preservation and Storage Requirements Table.	Attachment A	24 Feb 2010	J Hess
1.2	Remove references to SOPs currently under revision for inclusion of CLP procedures.	Pgs 4-5	06 Aug 2010	J Hess
2.0	Added in SW846 Revision 4	Attachment A	13 Jun 2013	NA
2.1	Updated organization name. No other changes needed.	All	6 Aug 2014	J Hess

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Table of Contents

1.0 PURPOSE

The objective of this procedure is to establish a uniform method for the handling of environmental samples. This includes using the appropriate sample containers and preservatives, following correct chain-of-custody procedures, and using appropriate sample shipment methods.

2.0 SCOPE AND APPLICABILITY

This procedure will be used during the collection and handling of all types of environmental media, including but not limited to, groundwater, surface water, soil, sediment, and air samples.

This procedure applies to the shipping and packing of all non-hazardous samples. Non-hazardous samples are those that do not meet any hazard class definitions found in 49 CFR 107-178, including materials designated as Class 9 materials and materials that represent Reportable Quantities (hazardous substances). In general, most soil, air, and aqueous samples do not meet any of DOT's hazardous materials definitions. However, samples for which screening has shown a potential hazard sufficient to meet a DOT definition or that are derived from a source known or suspected to meet a DOT definition must be packaged and shipped in accordance with applicable DOT and/or IATA requirements.

3.0 ACRONYMS AND DEFINITIONS

For purposes of this procedure, a number of terms and acronyms have the meanings defined below.

°C:	degrees Celcius
Bubble wrap:	Plastic sheeting with entrained air bubbles; used for protective packaging purposes.
CFR:	Code of Federal Regulations
CLP:	Contract Laboratory Program
COC:	Chain-of-custody
Cooler:	Any hard-sided insulated container meeting DOT or IATA packaging requirements.
DOT:	U.S. Department of Transportation.
IATA:	International Air Transport Association.
Packing material:	Styrofoam beads ("peanuts"), or equivalent
PPE:	Personal protective equipment.
QAPP:	Quality Assurance Project Plan
Shipping container:	*see* Cooler
VOA vial:	40-mL glass vial used for the collection of samples for volatile organic analysis.

4.0 EQUIPMENT AND MATERIALS

Equipment and materials that may be required to implement this SOP include the following:

- Bubble wrap
- Packing material
- Tape (packing tape, duct tape, or other tear-resistant material)
- Large plastic trash bags
- Ziploc bags (freezer grade, gallon and quart sizes)
- Shipping containers (e.g. coolers)
- Sample container(s) as specified in the approved project plans
- Ice
- Custody seals
- "This Side Up" arrows
- Address labels and/or airbills
- Chain-of-Custody forms
- Sample Collection Forms, Daily Activity Reports, activity-specific sampling forms
- Black waterproof pen (e.g., fine-point Sharpie marker).

5.0 PROCEDURE

5.1 GENERAL

The following method outlines general considerations for sample handling in the field and maintaining sample custody after collection.

Environmental samples are collected in the field in order to evaluate whether conditions in soil gas, soil, surface water, groundwater or atmosphere are hazardous. These samples therefore, should be handled with the utmost care to maintain sample integrity, so that analytical data represent field conditions as closely as possible. In addition, sample care, custody, and control are extremely important for establishing that sample integrity was maintained between field crews and the laboratory.

General considerations for handling during sampling are:

- Always wear proper PPE when handling samples.

- Wrap sample container in a way that is both protective of the sample container and other surrounding sample containers.
- Document all collection procedures thoroughly in sampling forms (e.g. Sample Collection Form) and general field notes in the Daily Activity Report (or field logbook, when applicable). There is never "too much information".

Samples must be stabilized for transport from the field to the laboratory through the use of the proper sample containerization and preservation. This is due to the potential chemical and/or biological degradation that may occur after samples are collected. Typical sample containerization and preservation are presented in Appendix A. Unless otherwise indicated in the site-specific QAPP, sample containers should be cooled immediately after completion of sampling and maintained at a temperature not to exceed the temperature specified in Attachment A until received by the laboratory.

5.2 SAMPLE CONTAINERIZATION AND PRESERVATION

The appropriate sample container types, volumes, preservatives, and holding time requirements for soil and groundwater samples for the most commonly requested analyses are listed in Attachment A, Sample Preservation and Storage Requirements.

Methods of sample preservation are intended to retard biological action, retard hydrolysis, and reduce sorption effects. Preservation methods are generally limited to pH control, chemical addition, refrigeration, and protection from light.

All sample containers will be properly labeled and monitored for temperature control in the field and during laboratory transport and storage. Temperature blanks will be used in all coolers containing samples requiring preservation at reduced temperature.

5.3 SAMPLE IDENTIFICATION AND LABELS

All samples will be properly labeled to prevent misidentification of samples. Generally, preprinted sample labels are encouraged to enhance legibility and reduce transcription errors at the laboratory. The label will be affixed to the sample container prior to transportation to the laboratory and will generally contain the following information (except when using CLP):

- Project name, number, and location
- Site name
- Name of collector
- Date and time of collection
- Sample identification number
- Preservative, if any
- Requested test methods or analyses.

See the site-specific QAPP for any additional sample identification protocols.

5.4 CHAIN OF CUSTODY

Chain-of-custody (COC) procedures are implemented to ensure that all samples are traceable from the time that they is collected until they, or their derived data, are used. A sample is considered to be "in custody" under the following conditions:

- It is in personal possession.
- It is in personal view after being in personal possession.
- It was in personal possession when it was properly secured.
- It is in a designated secure area.

Sample custody will be documented through the use of COC forms. These forms will be used to track sample custody from the point of sample collection through sample disposal. The security of samples will be ensured by the use of the procedures described below.

5.4.1 Chain-of-Custody Forms

A COC form will be filled out for and will accompany every group of samples sent to the analytical laboratory, to document sample care, custody, and control from the time of collection to sample receipt. See SOP PR-TC-01.04.05.00 for a copy of the latest COC form and on how to properly complete the form.

The following information will be recorded on the COC form:

- COC form number
- Company name, address, and telephone number
- Company contact person
- Laboratory name, address, and telephone number
- Laboratory contact person
- Sample identification
- Date and time of collection
- Sampler's name
- Analytical method(s) requested
- Sample volume (e.g., three 40-milliliter [mL] vials)
- Sample matrix (e.g., soil or groundwater)
- Preservative (e.g., hydrochloric acid [HCl])
- Request for matrix spike analysis or other QC analysis
- Signatures of individuals releasing and accepting samples
- Times of release and acceptance of samples
- Air bill number if shipping by commercial courier

- Any comments to identify special conditions or requests.

5.4.2 Custody Seals

Custody seals will be used when samples are shipped via courier service, and must be placed on the shipping container (cooler) so that the seals have to be broken before the container can be opened. The seal must be signed and dated by the field personnel. Custody seals are not deemed necessary when the samples will be in the continuous possession of project, field, or laboratory personnel.

5.5 PACKAGING FOR SHIPMENT

Samples will be packaged for shipment as follows:

- Use tape to seal off the cooler drain on the inside and outside to prevent leakage.
- Place packing material (bubble wrap) on the bottom of the shipping container (cooler) to provide a soft impact surface.
- Place a 55-gallon or equivalent plastic bag into the cooler (to minimize the possibility of leakage during transit).
- Place each sample bottle or set of volatile organic analysis (VOA) vials in a separate plastic bag and seal the bag. Squeeze air from the bag before sealing.
- Starting with the largest glass containers, wrap each container with sufficient bubble wrap to ensure the best chance to prevent breakage of the container.
- Pack the largest glass containers in bottom of the cooler, placing packing material between the containers to partially cover the sample containers (more than halfway) to avoid breakage from bumping. Cardboard separators may be placed between the containers at the discretion of the shipper.
- Double-bag ice chips or cubes in gallon or quart freezer-grade Ziploc plastic bags and wedge the ice bags between the sample containers.
- Add bagged ice across the tops of the samples.
- Continue filling the shipping container in the same manner (e.g., using bubble-wrap and ice) with smaller sample containers/vials.
- When the container is sufficiently full (or all samples have been packed), seal the inner protective plastic bag (with twist-ties and/or packing tape), and place additional packing material on top of the bag to minimize shifting of containers during shipment.
- Tape a gallon Ziploc bag to the inside of the cooler lid, place one copy of the completed COC document for the shipment inside, and seal the bag shut.
- Tape the shipping container (cooler) shut using packing tape, duct tape, or other tear-resistant adhesive strips. Taping should be sufficient to ensure that the lid will not open during transport.

- In situations where samples will not be in the continuous possession of project, field, or laboratory personnel, place custody seals on two separate portions of the cooler, to provide evidence that the lid has not been opened prior to receipt by the intended recipient.

5.5.1 Labeling

Label the shipping container/cooler as follows:

- Attach a “This Side Up” arrow securely to each side of the cooler. Affix "fragile" or other labels on the cooler as appropriate.
- Attach a label with the name and address of the receiver and the shipper to the top of the cooler.
- If the cooler is to be shipped by overnight carrier, attach a properly completed airbill to the top of the cooler.

6.0 ATTACHMENTS

- Attachment A: Sample Preservation and Storage Requirements

7.0 FORMS

The following forms are attached:

- None

8.0 REFERENCES

ITSI, 2006. *Final Chemical Data Quality Management Plan, 8(a) Remedial Action Contract Number N68711-005-D-6403*. January.

U.S. Department of Transportation Regulations, 49 CFR Parts 108-178.

International Air Transport Association (IATA), Dangerous Goods Regulations, current edition.

Attachment A

Sample Preservation and Storage Requirements
PR-TC-02.04.01.01

Matrix	Analytical Group	Analytical Method	Containers (number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Water	VOC	Gasoline Range Organics (GRO) 8015B	3 X 40 mL VOA vials with PTFE septa	HCL to pH < 2 / 4 ± 2°C	14 days analysis
Water	VOC	Gasoline Range Organics (GRO) 8015C	3 X 40 mL VOA vials with PTFE septa	HCL to pH < 2/ ≤ 6 °C	14 days analysis
Water	VOC	Gasoline Range Organics (GRO) 8015D	3 X 40 mL VOA vials with PTFE septa	HCL to pH < 2/ ≤ 6 °C	14 days analysis
Water	VOC	GCMS VOCs 8260B	3 X 40 mL VOA vials with PTFE septa	HCL to pH < 2 / 4 ± 2°C	14 days analysis (7 days unpreserved)
Water	VOC	GCMS VOCs 8260C	3 X 40 mL VOA vials with PTFE septa	HCL to pH < 2/ ≤ 6 °C	14 days analysis (7 days unpreserved)[a,b]
Water	VOC	GC VOCs 8021B (SW846 Update III)	3 X 40 mL VOA vials with PTFE septa	HCL to pH < 2 / 4 ± 2°C	14 days analysis (7 days unpreserved)
Water	VOC	GC VOCs 8021B (SW846 Update IV)	3 X 40 mL VOA vials with PTFE septa	HCL to pH < 2 / ≤ 6 °C	14 days analysis (7 days unpreserved)[b]
Water	SVOC	Phenols 8041A (SW846 Update III)	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Phenols 8041A (SW846 Update IV)	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Organochlorine Pesticides 8081A	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Organochlorine Pesticides 8081B	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Polychlorinated Biphenyls (PCBs) 8082	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Polychlorinated Biphenyls (PCBs) 8082A	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	None
Water	SVOC	Organophosphorus Pesticide 8141A	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Organophosphorus Pesticide 8141B	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)

Attachment A

Sample Preservation and Storage Requirements
PR-TC-02.04.01.01

Matrix	Analytical Group	Analytical Method	Containers (number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Water	SVOC	Chlorinated Herbicides 8151A (SW846 Update III)	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Chlorinated Herbicides 8151A (SW846 Update IV)	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	GCMS SVOC 8270C	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	GCMS SVOC 8270D	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Dioxins and Furans 8280A; 8290	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C, store in the dark	30 days extraction 45 days analysis (after extraction)
Water	SVOC	Dioxins and Furans 8280B; 8290A	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	None
Water	SVOC	Polycyclic Aromatic Hydrocarbons 8310 (SW846 Update III) ; 8270CSIM	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Polycyclic Aromatic Hydrocarbons 8310 (SW846 Update IV); 8270DSIM	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Nitroaromatics and Nitroamines 8330A; 8330B	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Diesel and Oil Range Organics (DRO and ORO) 8015B	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Diesel and Oil Range Organics (DRO and ORO) 8015C	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Diesel and Oil Range Organics (DRO and ORO) 8015D	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)
Water	Metals	ICP-AES Metals 6010B; 6010C	1 X 500 mL plastic	HNO_3 to pH < 2	6 months analysis
Water	Metals	ICP-MS Metals 6020; 6020A	1 X 500 mL plastic	HNO_3 to pH < 2	6 months analysis

Attachment A

Sample Preservation and Storage Requirements
PR-TC-02.04.01.01

Matrix	Analytical Group	Analytical Method	Containers (number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Water	Metals	Mercury by CVAA 7470A (SW846 Update III)	1 X 500 mL plastic	HNO_3 to pH < 2; 4 $\pm$ 2°C	28 days analysis
Water	Metals	Mercury by CVAA 7470A (SW846 Update IV)	1 X 500 mL plastic	HNO_3 to pH < 2; $\leq$ 6 °C	28 days analysis
Water	Inorganic	Hexavalent Chromium 7196A; 7199	1 X 250 mL plastic	4 $\pm$ 2°C	24 hours analysis
Water	Inorganic	Hexavalent Chromium 7196A; 7199	1 X 250 mL plastic	$\leq$ 6 °C	24 hours analysis
Water	Inorganic	Anions by IC 300.0 / 9056A (S846 Update III)	1 X 250 mL plastic	4 $\pm$ 2°C	48 hours for nitrate, nitrite, and orthophosphate analysis 28 days for chloride, sulfate, bromide, and fluoride analysis
Water	Inorganic	Anions by IC 300.0 / 9056A (SW846 Update IV)	1 X 250 mL plastic	$\leq$ 6 °C	48 hours for nitrate, nitrite, and orthophosphate analysis 28 days for chloride, sulfate, bromide, and fluoride analysis
Water	Inorganic	Nitrate and Nitrite as N Total 353.2	1 X 250 mL plastic	H_2SO_4 to pH < 2 / 4 $\pm$ 2°C	28 days analysis
Water	Inorganic	Kjeldahl Nitrogen 351.4 / SM 4500NH3-C	1 X 250 mL plastic	H_2SO_4 to pH < 2 / 4 $\pm$ 2°C	28 days analysis
Water	Inorganic	Chemical Oxygen Demand (COD) 410.4 / SM 5220D	1 X 250 mL plastic	H_2SO_4 to pH < 2 / 4 $\pm$ 2°C	28 days analysis
Water	Inorganic	Alkalinity SM 2320B / 310.1	1 X 250 mL plastic	4 $\pm$ 2°C	14 days analysis
Water	Inorganic	Total Dissolved Solids (TDS) SM 2540C / 160.1	1 X 250 mL plastic	4 $\pm$ 2°C	7 days analysis
Water	Inorganic	pH SM 4500-H+B	1 X 250 mL plastic	None	15 minutes analysis
Water	Inorganic	pH 150.1	1 X 250 mL plastic	None	24 hour analysis

Attachment A

Sample Preservation and Storage Requirements
PR-TC-02.04.01.01

Matrix	Analytical Group	Analytical Method	Containers (number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Water	Inorganic	Conductivity SM 2510B / 120.1	1 X 250 mL plastic	4 $\pm$ 2°C	28 days analysis
Water	Radiochem	Gross Alpha/Gross Beta 900.0	500-mL glass or plastic	HNO_3 to pH < 2	6 months analysis[e]
Water	Radiochem	Gamma-Emitting Radionuclides 901.1	2 X 1-liter glass or plastic	HNO_3 to pH < 2	6 months analysis[e]
Water	Radiochem	Radium-226 by Radon Emanation 903.1	2 X 1 liter glass or plastic	HNO_3 to pH < 2	6 months analysis[e]
Water	Radiochem	Gamma Radioassay HASL300 GA-01-R	2 X 1 liter glass or plastic	HNO_3 to pH < 2	6 months analysis[e]
Water	Radiochem	Radium-228 EPA 904.0	2 X 1 liter glass or plastic	HNO_3 to pH < 2	6 months analysis[e]
Water	Radiochem	Strontium-90 905.0	2 X 1 liter glass or plastic	HNO_3 to pH < 2	6 months analysis[e]
Water	Radiochem	Tritium 906.0	2 X 1 liter glass or plastic	None	6 months analysis[e]
Water	Radiochem	Plutonium 238 and 239/240 HASL 300-Pu-11	2 X 1 liter glass or plastic	HNO_3 to pH < 2	6 months analysis[e]
Water	Radiochem	Uranium-234, -235, and -238 HASL 300 U-02-RC	2 X 1 liter glass or plastic	HNO_3 to pH < 2	6 months analysis[e]
Soil	VOC	Gasoline Range Organics (GRO) 8015B	3 X 5g EnCore® or equivalent	4 $\pm$ 2 °C	48 hours until transfer to glass vials – 14 days analysis / 7 days if no acid (including 48 hours)
Soil	VOC	Gasoline Range Organics (GRO) 8015C	3 X 5g EnCore® or equivalent	$\leq$ 6 °C	48 hours until transfer to glass vials – 14 days analysis / 7 days if no acid (including 48 hours)
Soil	VOC	Gasoline Range Organics (GRO) 8015D	3 X 5g EnCore® or equivalent	$\leq$ 6 °C	48 hours until transfer to glass vials – 14 days analysis / 7 days if no acid (including 48 hours)
Soil	VOC	GCMS VOCs 8260B	3 X 5g EnCore® or equivalent	4 $\pm$ 2 °C	48 hours until transfer to glass vials – 14 days analysis / 7 days if no acid (including 48 hours)

Attachment A

Sample Preservation and Storage Requirements
PR-TC-02.04.01.01

Matrix	Analytical Group	Analytical Method	Containers (number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Soil	VOC	GCMS VOCs 8260C	3 X 5g EnCore® or equivalent	$\leq$ 6 °C	48 hours until transfer to glass vials – 14 days analysis / 7 days if no acid (including 48 hours)[a]
Soil	VOC	GC VOCs 8021B (SW846 Update III)	3 X 5g EnCore® or equivalent	4 $\pm$ 2 °C	48 hours until transfer to glass vials – 14 days analysis / 7 days if no acid (including 48 hours)
Soil	VOC	GC VOCs 8021B (SW846 Update IV)	3 X 5g EnCore® or equivalent	$\leq$ 6 °C	48 hours until transfer to glass vials – 14 days analysis / 7 days if no acid (including 48 hours)
Soil	SVOC	Phenols 8041A (SW846 Update III)	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	4 $\pm$ 2 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Phenols 8041A (SW846 Update IV)	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	$\leq$ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Organochlorine Pesticides 8081A	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	4 $\pm$ 2 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Organochlorine Pesticides 8081B	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	$\leq$ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Polychlorinated Biphenyls (PCBs) 8082	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	4 $\pm$ 2 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Polychlorinated Biphenyls (PCBs) 8082A	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	$\leq$ 6 °C	None
Soil	SVOC	Organophosphorus Pesticides 8141A	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	4 $\pm$ 2 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Organophosphorus Pesticides 8141B	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	$\leq$ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Chlorinated Herbicides 8151A (SW846 Update III)	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	4 $\pm$ 2 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Chlorinated Herbicides 8151A (SW846 Update IV)	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	$\leq$ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	GCMS SVOCs 8270C	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	4 $\pm$ 2 °C	extraction - 14 days analysis - 40 days

Attachment A

Sample Preservation and Storage Requirements
PR-TC-02.04.01.01

Matrix	Analytical Group	Analytical Method	Containers (number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Soil	SVOC	GCMS SVOCs 8270D	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	$\leq$ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Dioxins and Furans 8280A; 8290	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	4 $\pm$ 2 °C ; store in the dark	extraction - 30 days analysis - 45 days
Soil	SVOC	Dioxins and Furans 8280B; 8290A	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	$\leq$ 6 °C	None
Soil	SVOC	Polycyclic Aromatic Hydrocarbons 8310 (SW386 Update III); 8270CSIM	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	4 $\pm$ 2 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Polycyclic Aromatic Hydrocarbons 8310 (SW386 Update IV); 8270DSIM	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	$\leq$ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Nitroaromatics and Nitramines 8330A	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	$\leq$ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Nitroaromatics and Nitramines 8330B	1.5 grams of soil in specially prepared locking plastic bag	$\leq$ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Diesel and Oil Range Organics 8015B	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	4 $\pm$ 2 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Diesel and Oil Range Organics 8015C	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	$\leq$ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Diesel and Oil Range Organics 8015D	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	$\leq$ 6 °C	extraction - 14 days analysis - 40 days
Soil	Metals	ICP-AES 6010B; 6010C	Sleeves[c] with PTFE™ end caps or 4 oz glass jar	None	analysis - 6 months
Soil	Metals	ICP-MS 6020; 6020A	Sleeves[c] with PTFE™ end caps or 4 oz glass jar	None	analysis - 6 months
Soil	Metals	Mercury by CVAA 7471A	Sleeves[c] with PTFE™ end caps or 4 oz glass jar	4 $\pm$ 2 °C	analysis - 28 days
Soil	Metals	Mercury by CVAA 7471B	Sleeves[c] with PTFE™ end caps or 4 oz glass jar	$\leq$ 6 °C	analysis - 28 days
Soil	Inorganics	Conductivity 9050A/ 9050A	1 X 4 oz glass jar	4 $\pm$ 2 °C	analysis - 28 days

Attachment A

Sample Preservation and Storage Requirements
PR-TC-02.04.01.01

Matrix	Analytical Group	Analytical Method	Containers (number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Soil	Inorganics	Hexavalent Chromium 7196A / 7199 (SW846 Update III)	1 X 4 oz glass jar	4 $\pm$ 2 °C	analysis - 24 hours
Soil	Inorganics	Hexavalent Chromium 7196A / 7199 (SW846 Update IV)	1 X 4 oz glass jar	$\leq$ 6 °C	analysis - 24 hours
Soil	Inorganics	pH 9045D	1 X 4 oz glass jar	None	analysis - immediately
Soil	Radiochem	Gamma-Emitting Radionuclides 901.1M	1 X 16 oz glass or plastic jar[d]	None	6 months analysis[e]
Soil	Radiochem	Radium-226 by Radon Emanation 903.1M	1 X 16 oz glass or plastic jar[d]	None	6 months analysis[e]
Soil	Radiochem	Gamma Radioassay HASL300 GA-01-R	1 X 16 oz glass or plastic jar[d]	None	6 months analysis[e]
Soil	Radiochem	Radium-228 904.0M	1 X 16 oz glass or plastic jar[d]	None	6 months analysis[e]
Soil	Radiochem	Strontium-90 905.0M	1 X 16 oz glass or plastic jar[d]	None	6 months analysis[e]
Soil	Radiochem	Tritium 906.0M	1 X 16 oz glass or plastic jar[d]	None	6 months analysis[e]
Soil	Radiochem	Plutonium 238 and 239/240 HASL 300-Pu-11	1 X 16 oz glass or plastic jar[d]	None	6 months analysis[e]
Soil	Radiochem	Uranium-234, -235, and -238 HASL 300 U-02-RC	1 X 16 oz glass or plastic jar[d]	None	6 months analysis[e]

Abbreviations and Notes:
AES = Atomic Emission Spectrometry
°C = degrees centigrade
CVAA = Cold Vapor Atomic Absorption
GC = Gas Chromatography
HCl = Hydrochloric Acid
H2SO4 = Sulfuric Acid
IC = Ion Chromatography
ICP = Inductively Coupled Plasma
mL = milliliters
MS = Mass Spectrometry
oz = ounce
SVOC = Semi-volatile Organic Compounds
VOA = Volatile Organic Analysis
VOC = Volatile Organic Compounds

Attachment A

Sample Preservation and Storage Requirements
PR-TC-02.04.01.01

Abbreviations and Notes:

[a] If vinyl chloride, sytene, or 2-chloroethyl vinyl ether are analytes of interest, collect a second set of samples without acid preservatives and analyze as soon as possible (7 day hold time).

[b] If carbonaceous materials are present (or if MTBE and other fuel oxygenate ethers are present and a high temperature sample preparative method is to be used), do not acid preserve the sample.

[c] Sleeves may be stainless steel, acetate, brass or PTFE, depending on project needs.

[d] Sample volume and container dependent on required site-specific reporting limits. See the site-specific plan for details or variances such as tuna cans.

[e] Manual for the Certification of Laboratories Analyzing Drinking Water, EPA 815-B-97-001, March 1997 Criteria and Procedures Quality Assurance

Gilbane

Standard Operating Procedure

Sample Tracking and Electronic Data Management

PR-TC-02.12.02.00 v2.2

Prepared by: Kristen Carlyon Peyton Date: 14 June 2013

Kristen Carlyon Peyton, Senior Chemist

Reviewed by: Wing Tse Date: 14 June 2013

Wing Tse, Database Manager

Approved by: Jeffrey Hess Date: 14 June 2013

Jeffrey Hess, PG, CEM, Chief Scientist

Review / Revision History:

Version	Changes	Affects Section/Pages	Effective Date	Approval*
1.0	Initial Issue	–	30 Sep 2009	NA
1.1	Clarification of Project Chemist responsibilities, and corrections to section numbering.	Pages 2-4	30 Sep 2009	J. Hess
2.0	Reorganized procedures and responsibilities	Section 3-4	14 Jun 2013	NA
2.1	Updated definition of ERPIMS	Page 1	16 Jan 2014	J. Hess
2.2	Updated field procedures and flow chart	Pages 3-5, Flow Chart	14 Oct 2016	J.Hess

* Approval required for reviews and minor changes only. Substantive revisions to the technical requirements contained in the SOP require review and approval by the signatures to the SOP.

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Table of Contents

List of Figures

1.0 PURPOSE AND SCOPE

The purpose of this standard operating procedure is to describe the requirements and procedures for tracking environmental samples in a manner that will provide a systematic means of notifying our electronic data management group (including our chemists, database administrators, data management specialists, and other interested parties) of upcoming sampling events, ensuring the correct samples are collected and correct analyses are requested, tracking the receipt of analytical data from the laboratory for the sampling efforts, facilitate upload of electronic data to the database from the field crew and laboratories, and provide a reference for reconciliation of laboratory invoices.

2.0 ACRONYMS AND DEFINITIONS

For purposes of this procedure, a number of terms and acronyms have the meanings defined below.

COC: chain-of-custody form

CDQMP: Chemical Data Quality Management Plan

DQO: data quality objective

EDD: electronic data deliverable

eDMS: Environmental Data Management System, Gilbane's in-house environmental data management system.

ERPIMS: Environmental Resources Program Information Management System

FSP: Field Sampling Plan

Geotracker: A database and geographic information system (GIS) hosted by the California State Water Resources Control Board (SWRCB) that provides online access to environmental data.

GPS: global positioning system

LIMS: laboratory information management system

NIRIS: Naval Installation Restoration Information Solution

ORP: oxidation-reduction potential

PID: photo-ionization detector

QAPP: Quality Assurance Project Plan

SAP: Sampling and Analysis Plan

SEDD: staged electronic data deliverable

SOP: standard operating procedure

XRF: x-ray fluorescence

3.0 ROLES AND RESPONSIBILITIES

Project Manager. Establishes and communicates the goals and objectives (DQOs) of the sampling event to the team, and provides specifics regarding the number and type of samples, analytical methods, and any special reporting requirements. Authorizes payment of laboratory and validation invoices upon successful submittal of complete EDD.

Field Personnel. Responsible for the proper collection of environmental samples according to the approved SAP or FSP/QAPP. Responsible for accurate, defensible documentation of sample collection per approved project plans and corporate SOPs.

Sample Coordinator. Responsible for tracking the samples from time of collection through laboratory acceptance. Updates the Sample Tracking Log daily. Reconciles coolers contents against COCs prior to transfer to laboratory. Uploads COC and field information, including sample coordinates and field parameters, into eDMS daily. Submit samples to the laboratory. Sends COCs, Sample Collection Logs and other field forms to project team. Resolves completeness issues with laboratory (e.g. broken bottles, missing samples, etc.).

Project Chemist (or designee). Prepares SAP or FSP/QAPP and sample tracking log. Sets up site in eDMS and portal, if necessary. Loads eQAPP and sample schedule into eDMS. Uploads project planning documents to Gilbane project portal. Reviews COC and field information in eDMS. Reviews LIMS login report and resolves analytical issues with laboratory. Facilitates communication between lab and data group in upload of EDDs. Runs completeness test on EDDs against COCs to ensure all data has been received (this can be accomplished with the use of Event Planning reports). Reviews and finalizes results/validation qualifiers, releasing data for use. Updates Sample Tracking Log once samples are in the laboratory and for subsequent activities (e.g., data validation). Notify Project Manager upon successful submittal of completed EDDs.

Data Management Staff. Work with Project Chemist on setting up project and/or site, if new and updating existing projects as they evolve. Identify EDD reporting requirements (ERPIMS, NIRIS, SEDD, etc.) based on Contract and Task Order requirements. Manage any new user accounts needed based on staffing of project team. Work with Project Chemist on designation of sample IDs (and new location IDs, if required).

4.0 PROCEDURES

Systematic sample tracking and efficient data management require that the procedures presented in this SOP be followed by all parties involved in the collection and reporting of environmental data. Figure 1 outlines the generalized flow of sample information and laboratory results from initial sampling through reporting of the validated results. Although not specifically shown in Figure 1, these procedures are applicable to other field or laboratory generated environmental data from field instruments (e.g, chemical, radiological, geotechnical, water quality, and air monitoring), mobile field laboratories, and observations.

Procedures for managing the accurate collection and reporting of the data are discussed below. Roles and specific responsibilities are presented in Sections 3.1-3.3.

- **Kickoff Meeting**. A meeting is held with the project manager or task lead, the project chemist, and a representative of the data management team to communicate the goals and objectives (e.g., DQOs) of the sampling event to the team, and provide specifics regarding the number and type of samples, analytical methods, and any special reporting requirements.
- **Preparation of Sample Guidance Documents.** The SAP or FSP/QAPP is prepared by the project chemist, is reviewed by the project manager or task lead for consistency with the work plan and other project documents, and goes through both the internal and client approval process. The information contained in the approved SAP or FSP/QAPP is used to develop a Planned Sample Table / Sample Tracking Log.
- **Setup of Project Database.** If the site does not already exist in eDMS (Gilbane's web-based environmental data management system), a new database is created. If the site exists, a new project is added to the previously existing database. The quality control (QC) criteria from the SAP or QAPP is entered into eDMS, and (optionally) the information from the Planned Sample Table / Sample Tracking Log is entered into the Event Planning Tool.
    - The use of the Event Planning Tool allows for utilization of database tools such as electronic COCs, pre-printed labels, and completeness and performance reports. These are a requirement of some contracts, so be sure to complete this task if the project is under a contract requiring performance monitoring.
- **Sample Collection and Documentation**. Samples are collected in accordance with the approved site-specific project plans and chain-of-custody is properly documented.
- **Sample Tracking**. Samples are tracked from time of collection through laboratory acceptance. Issues with sample receipt (i.e., bottle breakage) are resolved. The Sample Tracking Log is updated in the field if event planning tool was not used.
- **Sample Entry**. COCs, Sample Collection Logs, and other field forms are submitted from the field team by scanning the field documentation and uploading to eDMS nightly. COC and appropriate field information (e.g., depth to water, water quality parameters) is then entered into eDMS daily, including field parameters and GPS coordinates.
    - Best practice (<u>and required by some clients</u>) is to collect GPS coordinates at time of sample collection even if a subsequent survey is planned later.
- **COC Review**. COC and field information is reviewed in eDMS. Laboratory LIMS login report is reviewed and analytical/login issues resolved with laboratory. The Event Planning Tool in eDMS is updated with required information (e.g., SDG associated with each sample).
- **EDD Upload**. The EDDs are uploaded to the project database. Upon successful upload, the laboratory report is available for review/validation.

- **Release of Data**. Review/validation is reviewed and approved. Sample Tracking Log is updated or if Event Planning was used, completeness reports are run. Once data is approved and shown to be complete, it can be released for use.
- **Review and Publication of Data**. Once data has been released for use, various reports can be run from eDMS to view the data in a variety of formats, and to review the data relative to applicable screening criteria and/or cleanup goals. The data is also available to incorporation into GIS for figure generation.
- **Generation of Deliverable EDDs**. Deliverable EDDs (i.e. NEDDs, ERPIMs, or SEDDs) are generated and uploaded as appropriate. Project Manager is notified of completion.

4.1 FIELD STAFF RESPONSIBILITIES

4.1.1 Notification of Sampling

At the beginning of each project involving the acquisition of environmental data, a preliminary meeting will be held by the project manager, project chemist and members of the electronic data management group to discuss the data quality objectives (DQOs), sampling requirements, and plan out preparation of the SAP or FSP/QAPP (including location and sample IDs). Once fieldwork is scheduled, a meeting between the project manager, project chemist and the field personnel prior to deployment will be conducted to discuss the specific requirements of the project. Specific information regarding the number and type of samples to be collected will be presented, along with recommended field procedures, sequence of work, and identity of the primary and secondary analytical laboratories. Sample naming protocols will be discussed to insure proper sample identification in the field and on Chains-of-Custody (COCs). The electronic data management group will be notified of the start of sampling at this time.

For multi-phase or recurring projects such as quarterly monitoring, both the project chemist and electronic data management group will be notified prior to the beginning of each sampling event, and a copy of the Sample Tracking Log will be provided to all interested parties prior to the initiation of sampling.

4.1.2 Chain-of-Custody

During field sampling activities, a copy of the COC will be uploaded daily by the sample coordinator to eDMS for access by the project chemist and data management staff.

- When the Event Planning tool is used in eDMS (the preferred approach), an electronic COC can replace a hand-written COC. Several fields will be pre-populated based on the sample tracking table and the room for hand-written error is greatly reduced. Internet connectivity is required to use this feature either on site or at a hotel or office before sampling begins. The COCs will be uploaded to the server nightly.
- If paper COCs are used, then COCs with a unique identification number should be used and can be requested through the your project chemist prior to the beginning of sampling. The location and sample IDs and the sample depths (top and bottom) for non-aqueous samples should be written on the copies of the COCs. The COCs will then be uploaded to eDMS nightly. In those cases where there is no internet access available, COCs are to be faxed daily and sent by FedEx at the end of each week.

- If Forms II Lite is used, a copy of the output files should be forwarded electronically to the Project Chemist and electronic data management group, along with a copy of the hard copy COC from the field printer for reference.

The data management group will review and QC COCs daily in eDMS.

4.1.3 Sample Coordinates and Other Field Notes

Along with the COCs, the sample coordinator will either: 1) directly load sample coordinates (from GPS) into eDMS; or 2) forward sample coordinates (from surveys) to be loaded into eDMS for each sample collected, with the exception of waste and some process samples, or recurring sample locations where coordinates already exist (e.g., previously surveyed monitoring wells). Please confirm the existence of valid coordinates for each sample location prior to sampling, otherwise collect GPS coordinates just in case. In addition, all field notes including boring logs, water levels, and field measurements will be uploaded on a daily basis to eDMS or to the data management group for entry into the system.

4.2 PROJECT CHEMIST RESPONSIBILITIES

4.2.1 Development of SAP or FSP/QAPP and Appropriate Location and Sample IDs

The Project Chemist is responsible for preparation of the SAP or QAPP/FSP and development of appropriate location and sample IDs in consultation with the Project Manager or Task Lead. A list of location IDs and their associated sample IDs should be sent to the data manager or their designee for approval before they are incorporated in the sampling plan. The location and sample IDs should conform to the location and sample ID nomenclature requirements listed in SOP PR-TC-01.04.04.00. Once the project plans are approved by the client, the Project Chemist shall upload the eQAPP in eDMS and request that the data manager set up the site in the eDMS. The project chemist shall setup the site in the Gilbane portal and upload the work plan to the portal.

4.2.2 Creation of Sample Tracking Log

The project chemist shall develop a Sample Tracking Log at the inception of the project. The log shall track the following items:

Pre-Sampling Post-Sampling

- Location ID
- Sample ID
- Sample matrix
- Required analyses
- Sample Date
- Date Submitted to Lab
- Laboratory Sample ID
- Status of data packages.
- Method predicted to be used for collecting samples

The project chemist shall submit the Sample Tracking Log to the data management group for use in setting up the Event Planning for each sampling event. This will allow for electronic COC use and electronic tracking of laboratory SDG status.

4.2.2.1 QC of Entry of COCs in eDMS

The project chemist (or designee) will QC the data entry of the COC information entered into eDMS. The sample identifications, analyses requested, sampling methods, matrices, dates and times of sample collections, and proper assignment of quality control samples will all be checked. The Project Chemist will also verify that the Sample Tracking Log has been updated, and will update the log if it has not been updated.

4.2.2.2 Cross-checking of Laboratory Receipt Form

Upon receipt of the samples by the laboratory, a completed chain-of-custody and laboratory receipt form shall be forwarded to the Project Chemist and crosschecked to the Sample Tracking Log (or online data management system) within 48 hours. Transcription errors and any minor differences will be resolved right away and documented through email correspondence. Major problems will be documented through the use of corrective action forms.

4.2.3 Receipt of Data and Data Uploads

As laboratory data packages are prepared and submitted to Gilbane, receipt of these data packages will be recorded on the Sample Tracking Log (or online data management system). The Project Chemist will facilitate communication between the lab and data management group to successfully load and certify EDDs. If not uploaded to eDMS by the lab, the electronic data deliverables (EDDs) in acceptable format (Enhanced ERPIMS unless otherwise approved) will be forwarded to the electronic data management group right away. The completeness of the EDDs will be verified upon receipt by the electronic data management group. eDMS will screen the results against the eQAPP. After errors (if any) are resolved, the EDD is certified by the person who uploaded it.

Validation using eDMS or a third-party validator occurs at this point. The validation codes are applied to eDMS and a validation report is prepared. The Project Chemist reviews and approves the qualifiers and again updates the Sample Tracking Log. At this point the data is approved by the Project Chemist for general use.

Upon completion of the receipt of the last sample for the sampling event (for example, one complete round of groundwater monitoring), a copy of the completed Sample Tracking Log will be forwarded to the electronic data management group for organization purposes

4.2.4 Reconciliation of Invoices

Upon receipt of laboratory invoices, the Project Chemist or his designee will cross-check the invoices against the sample tracking log to verify the receipt by Gilbane of all billed sample analyses, completed final data packages, and EDDs (accepted by the electronic data management group) before notifying the project manager that the invoices should be authorized for payment.

4.3 DATA MANAGEMENT GROUP RESPONSIBILITIES

4.3.1 Upload of Sample Information and Field Data to Database

The data management group will use the information in the sample tracking log and/or Event Planning tool in eDMS and the COCs as they are received in preparation for the upload of the electronic data deliverables (EDDs) directly from the laboratory or from laboratory provided electronic files.

Upon receipt of the sample-tracking log, the data management group will review the log. Any immediate potential problems (for example, the use of the dash '-' instead of an underscore '_' in the laboratory data system) that may follow in the preparation of the EDD will be identified and corrected.

4.3.1.1 Entry of COCs

The data management group will enter the COC information into eDMS. The sample identifications, analyses requested, sampling methods, matrices, sample depths, dates and times of sample collections, and proper assignment of quality control samples will be cross-checked for accuracy. The Sample Tracking Log will be updated as each COC is entered.

4.3.1.2 Entry of Other Field Data

Other data to be entered by the data management group includes water levels, field stability parameters (dissolved oxygen, ORP, turbidity, etc.), and GPS or survey coordinates. Additional data may include results of XRF field sampling, immunoassay test kit sampling, PID measurements, or other information required to be electronically provided to the client (typically any data used to make a regulatory decision), important for data review and analysis.

4.3.2 Creation of Final Data Package

The data management group will consolidate the validated EDDs from the in-house and/or third-party data validation firms with field information needed to complete the required data package. The final data package will then be submitted to the client in the required format (ERPIMS, NIRIS, Geotracker, etc.)

5.0 REQUIRED DOCUMENTATION

The following records generated as a result of implementation of this procedure must be maintained as quality records.

- Completed COCs
- Sample Collection Logs
- GPS coordinates for each sample collected
- Sample Tracking Log (if event planning not performed).
- Field notes

6.0 ATTACHMENTS

None.

7.0 FORMS

- Sample Tracking Log

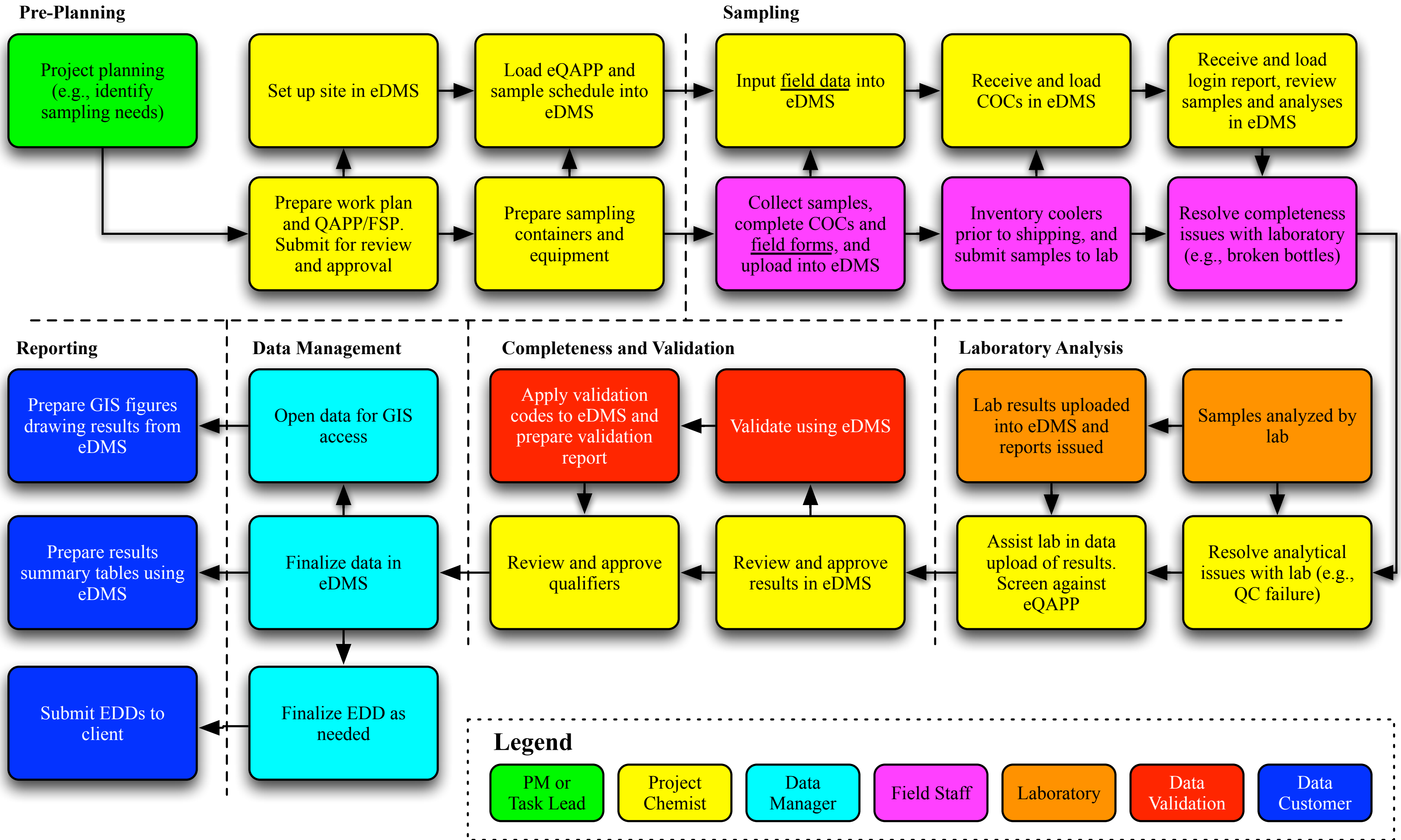
8.0 REFERENCES

None.

Sample Tracking Log

												Analyses								
Event	Location ID	Sample Type	Field QC	Date Sampled	Time	Sample ID	Date Shipped	Date Received	Chain of Custody	Laboratory Work Order No.	Laboratory Sample No.	TPH-DRO & MO by EPA 8015B	VOCs by EPA 8260	SVOCs by EPA 8270C	Title 22 Metals by 6010/6020/7000	Percent Moisture by ASTM D2216	Report Received	EDD Received	Data on eDMS	Notes

Figure 1. Gilbane Data Management Workflow



Field data includes environmental measurements collected during the course of collecting samples, and can include depth to water in a monitoring well, water quality parameters generated during purging, soil types classified during drilling, location information (by GPS), etc.

Field forms consist of the daily paperwork package generated during field events, including daily activity report (DAR), tailgate safety form, sample collection logs (as specified in the applicable SOPs), chain-of-custody forms, contractor production report (CPR), etc.

Standard Operating Procedure

Review, Verification, and Validation of Chemical Data

PR-TC-04.01.00.00 v3

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Approved by: ______________________ Date: 26 Apr 2018
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Review / Revision History:

Version	Changes	Affects Section/Pages	Effective Date	Approval*
1.0	Initial Issue	NA	27 Jul 2011	NA
1.1	Changed title to add the term "chemical data"		22 Nov 2013	J Hess
2.0	Revise procedures to document changes to process for updating validation codes.	Sections 4.2 & 4.3	17 Mar 2014	NA
2.1	Update validation checklists in eDMS	Section 6.0 & Attachments	13 Oct 2016	J Hess
3.0	Updated text to reflect updated government requirements and updated ADR procedures.	All	21 Mar 2018	NA

* Approval required for reviews and minor changes only. Substantive revisions to the technical requirements contained in the SOP require review and approval by the signatures to the SOP.

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Table of Contents

1.0 PURPOSE AND SCOPE

The purpose of this standard operating procedure (SOP) is to describe the requirements and procedures for data review and data validation, using both automated and manual procedures. Use of the procedures outlined in this SOP for procedures other than by an experienced data reviewer should be done with great caution.

2.0 ACRONYMS AND DEFINITIONS

For purposes of this procedure, a number of terms and acronyms have the meanings defined below.

3rd Party: An independent party not involved in the collection or analysis of the samples.

ADR: automated data review; an automated validation of electronic data deliverables against project and contract requirements entered into Gilbane's database, eDMS.

COC: chain-of-custody

DAR: Data Assessment Report

DQAR: Data Quality Assessment Report

% D: percent difference (also termed percent drift)

DV: data validation; the analyte- and sample-specific process that determines the analytical quality of a specific set of data.

EDD: electronic data deliverable; an electronic file containing, in a specific electronic format, laboratory data; an EDD is produces for each sample delivery group, and is used for uploading data to the eDMS. .

eDMS: environmental data management system

GCMS: gas chromatography/mass spectrometry

ID: identification

MS/MSD: matrix spike/matrix spike duplicate

QA: quality assurance

QC: quality control

QAPP: Quality Assurance Project Plan

QRT: qualified results table

RPD: relative percent difference

RSD: relative standard deviation

SDG: sample delivery group; a group of samples that is reported together under one laboratory identification number.

SAP: Sampling and Analysis Plan

SOP: standard operating procedure

3.0 BACKGROUND

There are many competing procedures for the review and validation of chemical data. This SOP attempts to harmonize these differing procedures utilizing the most recent regulatory guidelines and the latest technology. The sections below provide the necessary background information used in developing these harmonized procedures.

3.1 GENERAL REQUIREMENTS

The general requirements for the review and/or validation of chemical data are outlined in the following documents (the relevant guidance will be identified in the SAP):

- *General Data Validation Guidelines* (Department of Defense [DoD], 2018)
- *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* (U.S. Environmental Protection Agency [EPA], 2009)

As described in these documents, some or all of following items (as applicable to the analytical method(s) used to generate the data) are considered and evaluated in a routine review of laboratory-generated data:

- Laboratory reports and chain of custody documentation, to check for errors and omissions;
- Laboratory case narratives, to check for anomalies and exceedances of QA/QC requirements;
- Laboratory reports, to check for correct reporting limits and units, and type of sensitivity limits (i.e. reporting limit/method detection limit versus limit of quantitation/limit of detection/detection limit);
- Extraction and analysis holding times;
- Method blank, trip blank, equipment blank, ambient blank, and rinse water blank data (to note any detected analytes and their respective concentrations and to check for frequency of collection);
- Surrogate compounds, the spiking levels, the resulting concentrations, and the percent recoveries;
- Laboratory control samples, the spiking levels, resulting concentrations, and percent recoveries;
- Laboratory duplicate samples, field duplicate samples, and relative percent differences (or replicates and relative standard deviation [RSD]).
- MS/MSD samples, the spiking levels, resulting concentrations, percent recoveries, and relative percent differences between the MS and MSD.

It should be noted that unless otherwise specified in the project-specific plans, as a policy, Gilbane has adopted the holding time decision criteria presented in the *General Data Validation Guidelines* (DoD, 2018).

In addition to the routine review procedure described above, more rigorous data validation will be conducted at a frequency prescribed in the project-specific sampling and analysis plan (SAP) or quality assurance project plan (QAPP). These reviews will evaluate the above items, plus each of the following (as applicable to the subject analytical methodology):

- Instrument initial calibrations, calibration levels, individual compound response factors for each level, and RSD or regression summaries of the response factors;
- Instrument continuing calibrations, calibration levels, individual compound response factors, and the percent difference (%D) or percent drift between the response factor and the response factor in the initial calibration;
- Initial and continuing blank summaries;
- Internal standard area counts and retention times, to compare to method-specified acceptance criteria;
- GC/MS tuning data and instrument performance checks, to compare to method-specified acceptance criteria;
- Data for serial dilution analyses, interference check samples, post-digestion spikes, and any method of standard additions (metals analyses only);
- Confirmation of positive results for second column or detector including percent difference between the two analytical concentrations that are greater than the detection limit;
- Raw data, including chromatograms, to check for correct transcription, interpretation, manual integrations, and compound identification;
- Injection logs for all instruments used for analysis of project sample;
- Preparation logs for all project samples and associated QA/QC samples;
- Date and time of analysis of project samples and associated QA/QC samples.

3.2 REGULATORY BASIS

The general requirements outlined in Section 3.1 were evaluated against guidelines and procedures outlines in the 2009 *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* by the U.S. Environmental Protection Agency (EPA) (EPA, 2009). This guidance document establishes specific terminology for data review and validation efforts. This terminology is being adopted here to facilitate a clear understanding by both the reviewer and the ultimate user of the data regarding the specific level of review and validation to which the data was subjected. This terminology is outlined below.

Table 1. Description of "Stages" Terminology

Stage	Validation Description	Label Codes
–	Not validated	NV
1	Completeness	S1VE, S1VM
2A	Completeness and sample-related QC	S2AVE, S2AVM, S2AVEM
2B	Completeness and both sample-related and instrument-related QC	S2BVE, S2BVM, S2BVEM
3	Completeness, both sample-related and instrument-related QC, and recalculation checks	S3VE, S3VM, S3VEM
4	Completeness, both sample-related and instrument-related QC, recalculation checks and review actual instrument outputs	S4VE, S4VM, S4VEM

The possible label codes are based on a combination of what "Stage" of review and/or validation was performed, and whether the review and/or validation was performed manually (M), electronically (E), or both (EM).

4.0 PROCEDURES

The specific protocols used are outlined below for the review and validation of analytical data consistent with the guidance presented in Section 3.1.

4.1 STAGE 1 VERIFICATION

Stage 1 verification, commonly referred to as a completeness check , of the laboratory analytical data package consists of verification of compliance and sample receipt conditions. The following items are considered and evaluated during Stage 1 verification of the sample delivery group (SDG):

- Chain-of-custody documentation including laboratory receipt information,
- Laboratory case narrative and summary report,
- Laboratory report signed by official laboratory representative,
- Requested samples analyzed,
- Requested analytes, sensitivity limits, sensitivity limit types and units.

Stage 1 can be completed either manually, electronically within eDMS, or a combination of the two.

4.1.1 Manual Stage 1

Specific procedures for manual Stage 1 verification are provided below:

1. Verify the laboratory report clearly identifies the laboratory receiving the samples and performing the analyses and that the laboratory report is signed by an official laboratory representative.
2. Review laboratory case narrative for anomalies and QC issues.

3. Verify the analytical methods specified in the SAP or QAPP were performed, and if substitutions were made, verify written instructions from the Gilbane Project Chemist specifying/allowing the substitution.
4. Review cooler receipts and sample login files for potential issues that may affect the usability of the samples (presence of custody seals, etc.) or validity of the reported results (receiving temperatures, etc.).
5. Verify all the target compounds identified in the SAP or QAPP for each of the analyses were reported by the laboratory.
6. Verify all the analyses for each of the samples listed on the chain-of-custodies were completed, the dates are present when the analyses were performed, the analyses were performed within the specified holding times, the requested reporting limits were obtained, and the results appropriately qualified.
7. Document review with Stage 1 Verification Checklist, included here in the Attachments.

4.1.2 Electronic Stage 1 Using eDMS

Much of a Stage 1 verification is by nature manual. For this reason, no specific procedures for electronic Stage 1 verification incorporating eDMS are provided.

Perform steps 1 through 4 as written above.

From the Gilbane Projects Portal (https://edms.gilbaneco.com), select the project in which you would like to run your report from the drop-down menu.

From the grey menu bar, select “Reports>Data Review Reports>ADR Report”.

A new screen will pop up. In “Status” choose “Loaded and Certified”, and a list of available SDGs should appear. Choose an SDG, and fill in the rest of the fields as appropriate. These are report headers and used for documentation purposes. At a minimum, fill in the data review quality control (QC) S1VEM (per Table 1 in Section 3.2). Select the “Display All” option of the Anomalies Display pull-down menu to generate a list of cases where the reported reporting limit (RL) exceeds that specified in the governing project document.

Use the last four fields as a case narrative for any qualifiers entered in the sample qualification tool that the ADR did not qualify.

Select “View Reports” and the bookmarked ADR Report will generate.

Verify that the total number of analyses presented in the “ADR Summary” match the total number of analyses requested on the COC. If there is a discrepancy, use the detailed “Batch Report” for more in-depth review.

Verify that there were no holding time exceedances by reviewing the “QC Outliers Report.”

Review the “Reporting Anomalies” to verify requested reporting limits were attained.

Document review using Stage 1 Validation Checklist, example presented in the Attachments. File completed checklist in the project library on eDMS and/or on server in project folder in Data Validation subfolder.

4.2 STAGE 2A VALIDATION

Stage 2A validation will evaluate and consider the items listed above for completeness, in addition to following:

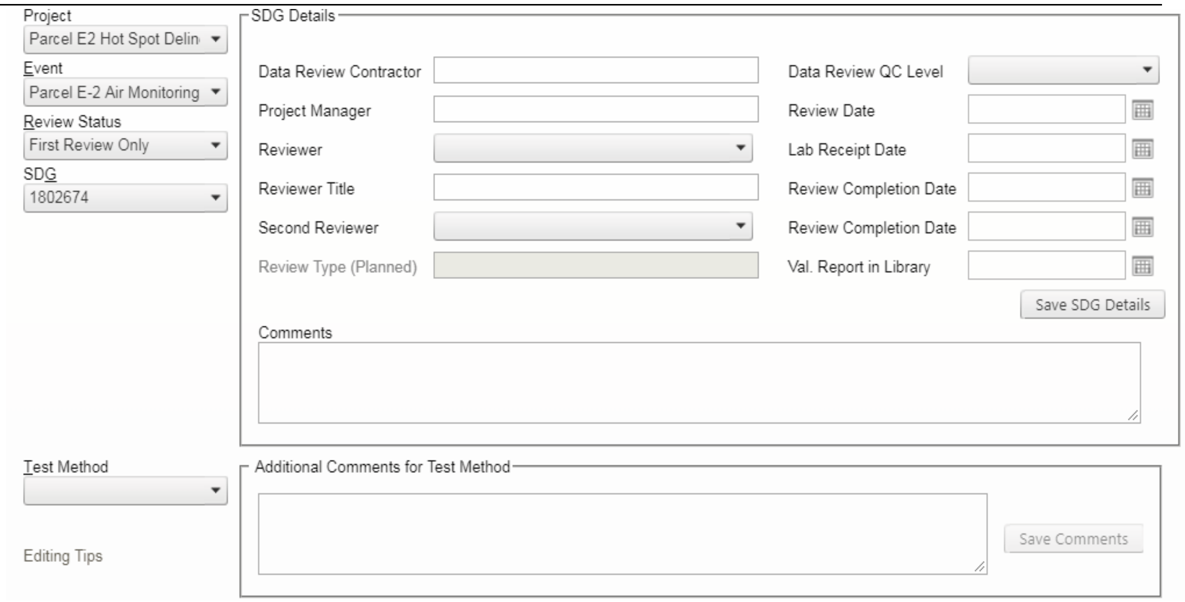
- Extraction and analysis holding times,
- Method blank, trip blank, equipment blank and ambient blank data,
- Surrogates,
- Matrix spikes and matrix spike duplicates,
- Field duplicates,
- Laboratory control samples, and
- Laboratory duplicates.

Stage 2A can be performed manually, but is preferentially performed electronically using eDMS. The following steps apply when performing automated data review (ADR) for Stage 2A within eDMS:

Data Validator (Gilbane or 3rd Party)

1. From the Gilbane Projects Portal (https://edms.gilbaneco.com), select the project in which you would like to run your reports from the drop-down menu.
2. From the grey menu bar, select "Reports>Data Review Reports>ADR LOD Detail"
3. The status pull-down menu will default to the most commonly used status ("Loaded and Certified"). Select the desired SDG, and fill in the balance of the items as desired.
4. Click "View Report" on the left hand side of the screen to generate the report.
5. Review the resulting report for QC Outliers and RL anomalies. (The report can be exported to Excel or PDF for ease of review by clicking on the export icon above the report.
    - On the Batch Report, verify all samples are being reported with the correct IDs. Verify the correct parameters were evaluated.
    - Skip to "QC Outlier Report" and review. Verify that both the correct control limits and correct warning limits were used to qualify the data. Check the outliers against the case narrative and check 10% against the hard copy.

      Note: If incorrect control or warning limits are discovered, send an email to the database manager or specialist with a correction request.
6. Return to the home screen and select Tools>Data – Review Checklist. Select the relevant project and event from left-hand side of the screen. Select whether it is the first or second review, or all if there will be only one.
7. Select the desired SDG from the left-hand side pull-down menu.
8. Select the SAP- or QAPP-specified validation level from the top-right hand Data Review QC Level pull-down menu, populate the balance of the upper fields, and click " Save SDG Details".



9. The Test Methods will become available once Save SDG Details has been clicked. Each method has an associated electronic checklist to be populated.
10. After the checklists are populated, edit/add qualifiers as necessary in the database by selecting “Tools>Sample Qualification” in the Gilbane Project Portal.
    a. If there are any necessary changes to “Qualified Results”, notify the project chemist immediately to determine if project setup needs to be adjusted to correct the issues and prevent the issue in the future.
11. Generate a Field Duplicate Report, if applicable, by choosing “Reports>Data Review Reports>Field Duplicate Reports by SDG.” Fill in the desired title of the report, select the project and event from the pull-down menu, select the SDG from the next pull-down menu, and click “View Report. Check that the correct parent and duplicate sample are identified, and that the correct limits are displayed in the RPD columns. If updates are necessary then:
    - Notify the Project Chemist of any changes that need to be made to project setup;
    - Select “Field Duplicate Reports by SDG (user criteria)” from the “Data Review Reports”; enter appropriate information and the RPD values for the inorganic or organic methods. Click “View Report” to verify the report. Export the report in desired format (i.e. pdf, by clicking down arrow next to “Select a format” and then clicking on “Export.” Note if there are any qualified outliers.
12. From the grey menu bar, select “Reports>Data Review Reports>ADR”.
13. The following screen will appear:

Status	Loaded and Certified ▼	SDG	<Select a Value> ▼
2nd Signature on Report	○ True ◉ False	Second Reviewer Title	
Logo to Display	▼	Report Title	Data Validation Report ▼
Display Modified Qualifications Table	◉ True ○ False	Display Trace Values Table	○ True ◉ False

14. The status pull-down menu will default to the most commonly used status (“Loaded and Certified”). Select the desired SDG, and fill in the balance of the items as desired.
15. The “Project” logo choice will provide a Gilbane logo. The “Company” logo defaults to Gilbane as well, but can be customized for those projects using third party validation by contacting the Database Manager at htse@gilbaneco.com and providing a company logo.
16. Click on “View Report” on the left hand side of the screen to generate the ADR.
17. From the “Select a format” pull down menu, select “PDF”, and click on export.
18. Combine the final ADR and the Field Duplicate Report into a single PDF and collect all applicable electronic signatures.
19. When reports have been generated and review process is complete select <Finalize Qualifiers> from main screen.

    Gilbane Project Chemist

20. Review the data validation report for consistency with project-specific requirements, validation guidelines (e.g., National Functional Guidelines, General DV Guidelines, etc.), and with this SOP. Work directly with the data validator to resolve any questions and any necessary changes. Once the data validation report is approved, the SDGs will be released for use by selecting <Approve SDG>.

4.3 STAGE 2B VALIDATION

For 2B validation, the following additional information will be reviewed:

- Initial and continuing calibration standards,
- Initial and continuing calibration blanks (for inorganic and metals analyses),
- Serial dilutions and post spikes, where applicable,
- Reporting limit verification standard, and
- Instrument tune and performance checks
- Internal standards (if summaries are available)
- Interference check standards

These additional steps apply when performing an ADR for 2B within eDMS:

Data Validator (Gilbane or 3rd Party)

1. Manually review those elements of the Stage 2B not covered by the ADR using the applicable sections of the Stage 2B Validation Checklist, example presented in the Attachments. These items include:
    - Initial and continuing calibration standards
    - Initial and continuing calibration blanks

- Serial dilutions and post spikes, where applicable
- Reporting limit verification standard
- Instrument tune and performance checks
- Internal standards (if summaries are available)

2. Additional qualification of data may result from the manual review. Narration of any additional qualification should be presented in the appropriate checklist and case narrative, if applicable..
3. Edit/add qualifiers as necessary in the database by selecting “Tools>Data - Sample Qualification” in the Gilbane Project Portal.
4. To add QC Outliers to the ADR Report, use either the “Apply Contamination Qualifiers” or “Apply Qualifiers with Outlier” functions in the Data- Sample Qualification Tool, as appropriate.
5. Generate a Field Duplicate Report, if applicable, by choosing “Reports> Data Review Reports>Field Duplicate Report by SDG.” Fill in the desired title of the report, select the event from the pull-down menu, select the SDG from the next pull-down menu, and click “View Report. Check that the correct parent and duplicate sample are identified and that the correct limits are displayed in the RPD columns. If updates are necessary then:
   - Notify the Project Chemist of any changes that need to be made to project setup;
   - Select “Field Duplicate Reports by SDG (user criteria)” from the “Data Review Reports”; enter appropriate information and the RPD values for the inorganic or organic methods. Click “View Report” to verify the report. Export the report in desired format (i.e. pdf, by clicking down arrow next to “Select a format” and then clicking on “Export.”
6. When reports have been generated and review process is complete select <Finalize Qualifiers>.
7. For the final report combine the ADR and Field Duplicate Report into one pdf file.

   Note: Depending on the requirements of the project, the ADR pdf alone may suffice as the final deliverable. Check with the Project Chemist for the specific requirements of each project.

   Gilbane Project Chemist

8. Review the data validation report for consistency with project-specific requirements, validation guidelines (e.g., National Functional Guidelines, General DV Guidelines, etc.), and with this SOP. Work directly with the data validator to resolve any questions and any necessary changes. Once the data validation report is approved, the SDGs will be released for use by selecting <Approve SDG>.

4.4 STAGE 3 AND 4 VALIDATION

Stage 3 validation will evaluate and consider the raw data associated with items reviewed in Stages 2A and 2B, in addition to following:

- Internal standards and retention times

- Manual integration
- Method of standard additions, linear range determinations, instrument detection limits, (metals analyses only)
- Method detection limit studies
- Sequence logs
- Preparation logs
- Raw data suitable for recalculation of results

For a Stage 4 review, add the review of the following instrument outputs:

- Raw data of chromatograms and spectra suitable for qualitative assessment

The following additional steps apply when performing the ADR within eDMS:

Data Validator (Gilbane or 3rd Party)

1. Manually review the raw data for calibrations, internal standards and retention times, tunes, serial dilutions, post-spikes, interference check samples, and MDLs, and perform raw data recalculations, and, if specified, review raw chromatograms and spectra using the Stage 3 and 4 Validation Checklists and Worksheets example presented in the Attachments.
2. Edit and review qualifiers as necessary in the database by following the instructions in Section 4.3 steps 3 and 4.
3. When reports have been generated and review process is complete, select <Finalize Qualifiers> from main screen.
4. For the final report, combine the ADR and Field Duplicate Report into one pdf file.

Gilbane Project Chemist

5. Review the data validation report for consistency with project-specific requirements, validation guidelines (e.g., National Functional Guidelines, General DV Guidelines, etc.), and with this SOP. Work directly with the data validator to resolve any questions and any necessary changes. Once the data validation report is approved, the SDGs will be released for use by selecting <Approve SDG>.

5.0 REQUIRED DOCUMENTATION

The following records generated as a result of implementation of this procedure must be maintained as quality records.

- ADR with checklists attached
- Field Duplicate Report (as applicable)

6.0 ATTACHMENTS

- Example eDMS checklists
- Example Manual Checklists
  - Stage 1 Verification Checklist
  - Stage 2 Validation Checklists
  - Stage 3 & 4 Validation Checklists and Worksheet

7.0 FORMS

None.

8.0 REFERENCES

U.S. Department of Defense (DoD), 2018. *General Data Validation Guidelines*. February.

U.S. Department of the Navy, Southwest Division (NAVFAC-SW), 2001. *Environmental Work Instruction #1, Data Validation Guidelines for Chemical Analysis of Environmental Samples*. 28 November.

U.S. Environmental Protection Agency (USEPA), 2009. EPA 540-R-8-005, *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use.* January.

ATTACHMENTS

- Example eDMS checklists
- Example Manual Checklists
    - Stage 1 Verification Checklist
    - Stage 2 Validation Checklists
    - Stage 3 & 4 Validation Checklists and Worksheet

Example eDMS Checklists

Item No.	Review Questions	Yes/No/NA	Comment
SW6010C – Inductively Coupled Plasma-Atomic Emission Spectrometry			
Stage 2B VEM			
1	Stage 2 Review: COC - Custody Trail?		
2	Stage 2 Review: COC - Temperature/Condition?		
3	Stage 2 Review: COC - Receipt anomalies?		
4	Stage 2 Review: COC - Sample/Methods checked?		
5	Stage 2 Review: Case Narrative - Anomalies?		
6	Stage 2 Review: Samples - Collection date?		
7	Stage 2 Review: Samples - Extraction date?		
8	Stage 2 Review: Samples - Analysis date?		
9	Stage 2 Review: Samples - Holding time?		
10	Stage 2 Review: Samples - Batching?		
11	Stage 2 Review: Samples - Lab qualifiers?		
12	Stage 2 Review: Calibration - ICAL?		
13	Stage 2 Review: Calibration - ICV?		
14	Stage 2 Review: Calibration - CCV?		
15	Stage 2 Review: Blank - Method blank?		
16	Stage 2 Review: Blank - Trip blank?		
17	Stage 2 Review: Blank - Equipment blank?		
18	Stage 2 Review: Precision/Accuracy - MS/MSD?		
19	Stage 2 Review: Precision/Accuracy - LCS/LCSD?		
20	Stage 2 Review: Quantitation - PQLs?		
21	Stage 2 Review: Quantitation - Dilution Factor?		
22	Stage 2 Review: Quantitation - Results (i.e. correct analytes)?		
23	Stage 2 Review: Field Duplicates - RPD within limits?		

SW8260B – Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)			
Stage 2B VEM			
1	Stage 2 Review: COC - Custody Trail?		
2	Stage 2 Review: COC - Temperature/Condition?		
3	Stage 2 Review: COC - Receipt anomalies?		
4	Stage 2 Review: COC - Sample/Methods checked?		
5	Stage 2 Review: Case Narrative - Anomalies?		
6	Stage 2 Review: Samples - Collection date?		
7	Stage 2 Review: Samples - Extraction date?		
8	Stage 2 Review: Samples - Analysis date?		
9	Stage 2 Review: Samples - Holding time?		
10	Stage 2 Review: Samples - Batching?		
11	Stage 2 Review: Samples - Surrogate recoveries?		
12	Stage 2 Review: Samples - Lab qualifiers?		
13	Stage 2 Review: Calibration - ICAL?		
14	Stage 2 Review: Calibration - ICV?		
15	Stage 2 Review: Calibration - CCV?		
16	Stage 2 Review: Blank - Method blank?		
17	Stage 2 Review: Blank - Trip blank?		
18	Stage 2 Review: Blank - Equipment blank?		
19	Stage 2 Review: Precision/Accuracy - MS/MSD?		
20	Stage 2 Review: Precision/Accuracy - LCS/LCSD?		
21	Stage 2 Review: Quantitation - PQLs?		
22	Stage 2 Review: Quantitation - Dilution Factor?		
23	Stage 2 Review: Quantitation - Results (i.e. correct analytes)?		
24	Stage 2 Review: Field Duplicates - RPD within limits?		

Example Manual Checklists

- Stage 1 Verification Checklist
- Stage 2 Validation Checklists
- Stage 3 & 4 Validation Checklists and Worksheet

Stage 1 Verification Checklist

Project Name: Project No.:

Laboratory: SDG #:

Reviewer: Organization:

CATEGORY		COMMENTS
SAMPLE RECEIPT FORM		
☐	Cooler temperature within control limits	
☐	Samples received intact within holding time	
RECONCILIATION OF CHAIN-OF-CUSTODY TO SDG		
☐	Sample IDs correct	
☐	Requested analysis received	
☐	Sample time and date received correct	
☐	Chain of custody maintained (i.e. signatures and line-outs)	
REVIEW OF SDG		
Review case narrative		
☐	Check for analytical holding times	
Review laboratory package		
☐	Verify analyses requested on COC for each sample were completed	
☐	Verify analytical methods specified in QAPP were performed, else written variance on file.	
☐	Verify all the target compounds identified in the QAPP for each of the analyses were reported by the laboratory.	
☐	Verify requested reporting limits were obtained, and that results were appropriately reported and qualified.	
☐	Check type of package requested (ie Level III, Level IV) was received.	

Stage 2 Review Checklist: Organics

Project Name: Project No.:

Laboratory: SDG #:

Reviewer: Organization:

Category	Method__________	Notes
COC		
Custody Trail		
Temperature/Condition		
Receipt anomalies		
Sample/Methods check		
Case Narrative		
Anomalies		
Samples		
Collection date		
Extraction date		
Analysis date		
Holding time		
Batching		
Surrogate recoveries		
Lab qualifiers		
Calibration (Stage 2b only)		
ICAL		
ICV		
CCV		
Blank		
Method blank		
Trip blank		
Equipment blank		
Precision/Accuracy		
MS/MSD		
LCS/LCSD		
Quantitation		
PQLs		
Dilution Factor		
Results (i.e. correct analytes)		
Field Duplicates		
RPD within limits		

Stage 2 Organic Checklist 072711.doc

Stage 2 Review Checklist: Metals

Project Name: Project No.:

Laboratory: SDG #:

Reviewer: Organization:

Category	**Method__________**	**Notes**
COC		
Custody Trail		
Temperature/Condition		
Receipt anomalies		
Sample/Methods check		
Case Narrative		
Anomalies (DQFs)		
Samples		
Collection date		
Extraction date		
Analysis date		
Holding time		
Batching		
Lab qualifiers		
Blank		
Method blank		
Equipment blank		
Calibration (Stage 2b only)		
ICAL		
ICV		
CCV		
LLCCV		
Precision/Accuracy		
MS/MSD		
LCS/LCSD		
Quantitation		
PQLs		
Dilution Factor		
Results		
Field Duplicates		
RPD in criteria		

Stage 2 Metals Checklist 072711.doc

Stage 3 & 4 Review Checklist: Organics

Project Name: Project No.:
Laboratory: SDG #:
Reviewer: Organization:

Category	Method__________	Notes
COC		
Custody Trail		
Temperature/Condition		
Receipt anomalies		
Sample/Methods check		
Case Narrative		
Anomalies		
Samples		
Collection date		
Extraction date		
Analysis date		
Holding time		
Batching		
Surrogate recoveries		
Internal standard recoveries		
Lab qualifiers		
Blank		
Method blank		
Trip blank		
Equipment blank		
Calibration		
ICAL		
ICV		
CCV		
Precision/Accuracy		
MS/MSD		
LCS/LCSD		
Instrument		
Tune		
Breakdown Standard		

Stage 3 & 4 Review Checklist: Organics

Project Name: Project No.:

Laboratory: SDG #:

Reviewer: Organization:

Quantitation		
PQLs		
Dilution Factor		
Results (RT, Ions, Rel. Itens.)		
Retention times		
Major ions present		
Relative intensities		
Column/Detector RPD		
Confirmation		
Result Recalculation		
Field Duplicates		
RPD within limits		
Review Chromatograms/Spectra (Stage 4 only)		

Stage 3-4 Organic Checklist 072711.doc

Stage 3 & 4 Review Checklist: Metals

Project Name: Project No.:

Laboratory: SDG #:

Reviewer: Organization:

Category	**Method___________**	**Notes**
COC		
Custody Trail		
Temperature/Condition		
Receipt anomalies		
Sample/Methods check		
Case Narrative		
Anomalies (DQFs)		
Samples		
Collection date		
Extraction date		
Analysis date		
Holding time		
Internal standard		
Batching		
Lab qualifiers		
Blank		
Method blank		
Calibration blank		
Equipment blank		
Calibration		
ICAL		
ICV		
CCV		
LLCCV		
Precision/Accuracy		
MS/MSD		
LCS/LCSD		
Post digestion spike		
Serial dilution		
Reporting Limit Std.		
Instrument		
ICSA		
ICSAB		
Tune		

Stage 3 & 4 Review Checklist: Metals

Project Name: Project No.:

Laboratory: SDG #:

Reviewer: Organization:

Quantitation		
PQLs		
Dilution Factor		
Results - Recalc		
Field Duplicates		
RPD in criteria		

Stage 3-4 Metals Checklist 072711.doc

Standard Operating Procedure

Review, Verification, and Validation of Radiological Data

PR-TC-04.01.02.00 v1.0a

Reviewed by: Kristen Carlyon Peyton, Senior Chemist — Date: 12 Oct 2016

Reviewed by: Evelyn Dawson, Senior Chemist — Date: 12 Oct 2016

Approved by: Jeffrey Hess, PG, CEM, Chief Scientist — Date: 12 Oct 2016

Review / Revision History:

Version	Changes	Affects Section/Pages	Effective Date	Approval*
1.0	Initial Issue	NA	12 Oct 2016	NA
1.0a	Reviewed, no update necessary	NA	21 Jun 2018	

* Approval required for reviews and minor changes only. Substantive revisions to the technical requirements contained in the SOP require review and approval by the signatures to the SOP.

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Table of Contents

1.0 PURPOSE AND SCOPE

The purpose of this standard operating procedure (SOP) is to describe the requirements and procedures for the review and validation of radiological data using primarily manual procedures. Use of the procedures outlined in this SOP for procedures other than by an experienced data reviewer should be done with great caution.

2.0 ACRONYMS AND DEFINITIONS

For purposes of this procedure, a number of terms and acronyms have the meanings defined below.

ADR: automated data review; an automated validation of electronic data deliverables against project and contract requirements entered into Gilbane's database, eDMS.

ANSI: American National Standards Institute

Carrier: A known mass of a non-radioactive isotope of the analyte (or stable isotope of a chemically similar element) used in analyses to determine chemical yield.

CDQMP: Chemical Data Quality Management Plan

Chemical Yield: A measure for losses that might have occurred during sample processing, separation, and quantification, as measured using a tracer or carrier. Chemical yield is expressed as the percent recovery.

COC: chain-of-custody

CSU: combined standard uncertainty. Standard uncertainty of an output estimate calculated by combining the standard uncertainties (one-sigma uncertainties) of the input estimates. Expanded uncertainty is the combined standard uncertainty multiplied by a "coverage factor" (e.g., 2 or 3) to obtain the two-sigma [95% probability] or three-sigma [99% probability] expanded uncertainty.

critical value (L_c): The minimum measured value (e.g., of the instrument signal or the radionuclide concentration) required to give a specified probability that a positive (non-zero) amount of radioactivity is present in the material being measured. Also known as the critical level, decision level (DL), and decision level concentration (DCL).

DAR: Data Assessment Report

DER: duplicate error ratio. A measure of the reproducibility of results calculated using the primary and duplicate sample results and combined standard uncertainties. Also known as relative error ratio (RER)

DL: decision level (see critical value)

DPM: disintegrations per minute

DQA: data quality assessment

DQAR: Data Quality Assessment Report

DQO: data quality objective

% D: percent difference (also termed percent drift)

DV: data validation; the analyte- and sample-specific process that determines the analytical quality of a specific set of data.

EDD: electronic data deliverable; an electronic file containing, in a specific electronic format, laboratory data; an EDD is produced for each sample delivery group, and is used for uploading data to the eDMS.

eDMS: environmental data management system.

ID: identification

MARLAP: Multi-Agency Radiological Laboratory Analytical Protocols Manual

MARSAME: Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual

MARSSIM: Multi-Agency Radiation Survey and Site Investigation Manual

MB: method blank

MDA: minimum detectable amount. Also known as the minimum detectable activity. The minimum amount or concentration of a radionuclide required within a given confidence that the measurement result would be above the DL (detected). This is typically based on a confidence level of 95%. Correspondingly, the probability of a Type II error (probability of erroneously not concluding a radionuclide is detected in a sample that has the MDA quantity or concentration) is typically set at 0.05. Thus the alpha (Type I) and beta (Type II) probabilities are both typically set at 0.05.

MDC: minimum detectable concentration (see MDA). There are two types of MDC:
(1) the "a priori" MDC calculated using nominal or typical analytical parameter values, typically used to evaluate the relative detection capabilities of specific analytical methods; and
(2) the "a posteriori" sample-specific MDC (ssMDC) calculated for a specific sample and using the sample-specific Lc (ssLc) and parameter values for the individual sample.

MS/MSD: matrix spike/matrix spike duplicate

MQO: measurement quality objective

QA: quality assurance

QC: quality control

QAPP: Quality Assurance Project Plan

QRT: qualified results table

RDL: required detection limit. Also known as the required minimum detectable concentration (RMDC).

RPD: relative percent difference

RSD: relative standard deviation

SDG: sample delivery group; a group of samples that is reported together under one laboratory identification number.

SAP: Sampling and Analysis Plan

SOP: standard operating procedure

TPU: total propagated uncertainty (TPU). See CSU (MARLAP, 2004).

Tracer: A known amount of a radioactive isotope chemically similar to the analyte used in analyses to determine chemical yield.

3.0 BACKGROUND

Historically there have been few formalized procedures for the review and validation of radiological data. This SOP attempts to develop specific procedures that are consistent with the available standards in order to provide for more uniform verification and validation of radiological data by Gilbane personnel and 3rd-party validation firms.

In 2012, the American Nuclear Society (ANS), working with the American National Standards Institute (ANSI), published *Verification And Validation Of Radiological Data For Use In Waste Management And Environmental Remediation* (ANSI/ANS–41.5–2012). This standard complements recommended practices in Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) (NUREG-1576, 2004) for planning radiological testing programs and for the laboratory analyses of radiological samples, and is adopted by Gilbane as the standard for data verification and validation of radiological data.

3.1 GENERAL REQUIREMENTS

3.1.1 Evaluation Criteria

As outlined in ANSI/ANS-41.5, the following items may be evaluated during the verification and validation of laboratory-generated radiological data:

- Sample Specific Parameters
  - Sample Preservation
  - Holding Time
  - Sample-specific Chemical Yield
  - Required Detection Limit (RDL)
  - Nuclide Identification
  - Quantification and Uncertainty
  - Detectability
  - Sample Aliquot Representativeness
- Batch Control Parameters
  - Laboratory Control Sample (LCS) Analysis
  - Matrix Spike (MS) Analysis
  - Duplicate and Matrix Spike Duplicate (MSD) Analysis
  - Batch Method Blank Analysis
- Instrument Parameters
  - Counting Efficiency Calibration
  - Energy Calibration
  - Background Determination

Additional evaluation steps are recommended as part of the laboratory selection and qualification process, and may be included in a laboratory desktop audit performed prior to or during preparation of the project-specific planning documents. See ANS/ANSI-41.5-2012 Sections 3.1 through 3.4.

3.1.2 Qualifying Radiological Data

The verification and validation process for radiological data involves a series of evaluations as outlined in Section 3.1.1, and culminates in a judgment of the quality and reliability of data, both individually and for an entire batch of data. Based on this judgment, appropriate qualifiers are assigned.

Radiological data should not be rejected without adequate cause, generally requiring a pattern of problems with a specific piece of data or batch of data to be rejected. As MARLAP indicates, "rejecting a result is an unconditional statement that it is not useable for the intended purpose. A result should only be rejected when the risks of using it are significant relative to the benefits of using whatever information it carries." MARLAP provides some general guidance to consider when thinking about rejecting data:

1. Insufficient or only incorrect data are available to make fundamental decisions about data quality. For example, if correctly computed uncertainty estimates are not available, it is not possible to do most of the suggested tests. If the intended use depends on a consistent, high level of validation, it may be proper to reject such data. The missing data should be fundamental. For example, missing certificates for standards are unlikely to be fundamental if laboratory performance on spiked samples is acceptable. In contrast, if no spiked sample data is available, it may be impossible to determine if a method gives even roughly correct results, and rejection may be appropriate.
2. Available data indicate that the assumptions underlying the method are not true. For example, QC samples may demonstrate that the laboratory's processes are out of control. Method performance data may indicate that the method simply does not work for particular samples. These problems should be so severe that is not possible to make quantitative estimates of their effects.
3. A result is very unusually uncertain. It is difficult to say what degree of uncertainty makes a result unusable. Whenever possible, uncertain data should be rejected based on multiple problems with one result, patterns in related data, and the validator's judgment, not the outcome of a single test. This requires radiochemistry expertise and knowledge of the intended use.

3.2 REGULATORY BASIS

The requirements outlined in Section 3.1 were evaluated against guidelines and procedures outlines in the 2009 *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* by the U.S. Environmental Protection Agency (EPA) (EPA, 2009). This guidance document establishes specific terminology for data review and validation efforts. This terminology is adopted here to facilitate a clear understanding by both the reviewer and the ultimate user of the data regarding the specific level of review and validation to which the data was subjected. This terminology is outlined below.

Table 1. Description of "Stages" Terminology

Stage	Validation Description	Label Codes
–	Not validated	NV
1	Completeness	S1VE, S1VM
2A	Completeness and sample-related QC	S2AVE, S2AVM, S2AVEM
2B	Completeness and both sample-related and instrument-related QC	S2BVE, S2BVM, S2BVEM
3	Completeness, both sample-related and instrument-related QC, and recalculation checks	S3VE, S3VM, S3VEM
4	Completeness, both sample-related and instrument-related QC, recalculation checks and review actual instrument outputs	S4VE, S4VM, S4VEM

The possible label codes are based on a combination of what "Stage" of review and/or validation was performed, and whether the review and/or validation was performed manually (M), electronically (E), or both (EM).

3.3 SPECIFIC CLIENT REQUIREMENTS

Based on a review of various client requirements (e.g. Department of Defense data item descriptions, NAVFAC-SW Environmental Work Instruction #1, *Chemical Data Validation* (NAVFAC-SW, 2001), EM 200-1-10, etc.) and their governing CDQMPs, the following table outlines the general guidelines for the review and/or validation of chemical data for various clients:

Table 2. Cross-Walk of Validation Requirements

Client	Target Validation Level	Equivalent Stage
Department of Defense		
Air Force/AFCEC	Level III	2A
	Expanded Level III	2B
	Level IV	3
Army/USACE	Level III	2A
	Expanded Level III	2B
	Level IV	3
Navy	Level III	2B (3rd party)
	Level IV	3 (3rd party)
Other Federal Agencies		
EPA	Tier 1A	1
	Tier 1B	2A or 2B
	Tier 2	4 (on subset of results)
	Tier 3	4

There may be specific contracts that require components of SEDD 2B as part of their Level III validation specifications; **ALWAYS** check the master contract language when specifying DV services under this SOP. As contract-specific requirements are identified, please send them to j.hess@gilbaneco.com so they may be incorporated into this SOP in a future update.

4.0 PROCEDURES

The specific protocols used are outlined below for the review and validation of analytical data consistent with our CDQMP and the EPA "Stage" approach.

4.1 STAGE 1 VERIFICATION

Stage 1 verification, commonly referred to as a completeness check (or level II verification), of the laboratory analytical data package consists of verification of compliance and sample receipt conditions. The following items are considered and evaluated during Stage 1 verification of the sample delivery group (SDG):

- Laboratory report signed by official laboratory representative
- Chain-of-custody documentation including laboratory receipt information
- Laboratory case narrative and summary report
- Requested samples analyzed
- Requested analytes reported
- Results include:
  - requested analyte results and associated uncertainty (and type of uncertainty)
  - laboratory data qualifiers and definitions
  - reporting limits

- sample-specific critical value and sample-specific minimum detectable value, activity or concentration for results at or below the critical value
- chemical yield (if applicable to method), reference date and time
- units (both for results and associated uncertainty)
- sampling dates

At this time, Stage 1 is performed manually, until such time as Gilbane's environmental data management system (eDMS) supports electronic review of radiological data.

4.1.1 Manual Stage 1

Specific procedures for manual Stage 1 verification are provided below:

1. Verify the laboratory report clearly identifies the laboratory receiving the samples and performing the analyses and that the laboratory report is signed by an official laboratory representative.
2. Review chain-of-custodies for proper custody, and cooler receipts and sample login files for potential issues that may affect the usability of the samples (presence of custody seals, etc.) or validity of the reported results (receiving temperatures, sample condition, etc.).
3. Review laboratory case narrative for anomalies and QC issues.
4. Verify the analytical methods specified in the project plan were performed, and if substitutions were made, verify written instructions were received from the Gilbane Project Chemist specifying/allowing the substitution.
5. Verify all the target compounds identified in the project plan for each of the analyses were reported by the laboratory.
6. Verify all the analyses for each of the samples listed on the chain-of-custodies were completed. Verify the requested reporting limits were obtained.
7. For each analysis, verify the following information is provided:
   - the dates when the samples were collected and when analyses were performed
   - the requested analyte results and associated uncertainty (and type of uncertainty)
   - laboratory data qualifiers and definitions
   - sample-specific critical value and sample-specific minimum detectable value, activity or concentration for results at or below the critical value
   - chemical yield (if applicable to method)
   - units (both for results and associated uncertainty)
8. Document review with Stage 1 Verification Checklist, included in Attachment A. Upload completed checklist to eDMS.

4.1.2 Electronic Stage 1 Using eDMS

Currently performing Stage 1 electronically is not supported in eDMS. However, if the SDG is uploaded into eDMS, the verification checklist present in eDMS can be utilized.

4.2 STAGE 2A VALIDATION

Stage 2A validation (which can include some or all of the components of level III validation, depending on client) will evaluate and consider the items listed above for completeness, in addition to the following:

- Sample Specific Parameters
  - Sample Preservation
  - Holding Time
  - Sample Specific Chemical Yield
  - Required Detection Limit (RDL)
  - Nuclide Identification
  - Quantification and Uncertainty
  - Detectability
  - Sample Aliquot Representativeness
- Batch Control Parameters
  - Laboratory Control Sample (LCS) Analysis
  - Matrix Spike Sample (MSS) Analysis
  - Duplicate and Matrix Spike Duplicate (MSD) Sample Analysis
  - Batch Method Blank Analysis

Stage 2A is performed manually, until such time as Gilbane's eDMS supports electronic review of radiological data. Document review with Stage 2A Verification Checklist, included in Attachment A, or if the SDG is uploaded into eDMS, the verification checklist present in eDMS can be utilized. Data qualifiers generated during the validation process are entered into eDMS, as eDMS is the definitive source of data for generation of tables and figures for reporting purposes. Attachment B provides guidance for entering in qualifiers into eDMS.

4.2.1 Sample Specific Parameters

Perform the following activities, using either the provided checklists or equivalent.

1. Verify required **sample preservation** was performed per the approved project plans (or laboratory SOP if not specified in the project plans). Qualify as estimated ("J/UJ") with the appropriate reason code or reject ("R") based on professional judgment those results for samples improperly preserved
2. Verify analyses were performed within the required **holding times** as stipulated in the approved project plans (or laboratory SOP if not specified in the project plans). Qualify as estimated ("J/UJ") with the appropriate reason code those results that exceeded holding times.
3. Verify **sample-specific chemical yield** was performed consistent with the approved project plan or method requirements (or laboratory SOP) if not specified. Qualify as estimated ("J/UJ") with the appropriate reason code those results with sample-specific chemical yield varied from acceptable method requirements.

4. Verify the MDA meets the **required detection limit** (RDL) for all analytes of interest as stipulated in the approved project plans. Qualify as estimated ("J/UJ") with the appropriate reason code those results for samples with the MDA not meeting the RDL.
5. Evaluate **detectability** by verifying results for all detected analytes of interest are greater than or equal to ("≥") their Lc, and that those analytes of interest with results below their Lc are appropriately qualified as non-detect ("U").

4.2.2 Batch Control Parameters

Verify QC parameters are within requirements stipulated in the approved project plans (or laboratory SOP if not specified in the project plans).

1. Verify the number of LCS analyses performed and the limits stipulated in the approved SAP (or laboratory SOP) were met.
   - Compare LCS analytical results to the bias and precision measurement quality objectives (MQOs) identified in the approved project plans. In general, individual LCS results should be compared with the least restrictive of the bias or precision MQO or overall measurement uncertainty MQO. Qualify as estimated ("J/UJ") with the appropriate reason code those results associated with a batch with LCS results outside specified control limits.
2. Verify the number of MS analyses performed and the limits stipulated in the approved project plans (or laboratory SOP if not specified in the project plans) were met.
   - Compare MS analytical results to the bias and precision measurement quality objectives (MQOs) identified in the approved project plans. In general, individual MS results should be compared with the least restrictive of the bias or precision MQO or overall measurement uncertainty MQO. Qualify as estimated ("J") with the appropriate reason code those results associated with a batch with MS results outside specified control limits.
3. Verify the number of duplicate and MSD analyses performed stipulated in the approved project plans (or laboratory SOP if not specified in the project plans) were met.
   - Compare relative percent difference (RPD) results for both duplicate and MSD analyses with the precision MQO stipulated in the approved project plans. If RPD is higher than stipulated in the approved project plans, evaluate duplicate results considering measurement uncertainty using a duplicate error ratio (DER) calculation against appropriate precision requirement. Use a DER limit of 2 (equivalent to 95% [2-sigma] confidence) if not otherwise stipulated in the approved SAP. Qualify as estimated ("J/UJ") with the appropriate reason code those results associated with a batch with RSD results greater than specified in the approved project plans.
4. Verify the number of Method blanks (MBs) performed stipulated in the approved project plans (or laboratory SOP if not specified in the project plans) was met. Qualify as estimated ("J/UJ") with the appropriate reason code those results associated with a batch with RSD results greater than specified in the approved project plans.

4.3 STAGE 2B VALIDATION

Most of Stage 2B is performed manually, until such time as Gilbane's eDMS supports electronic review of radiological data and associated QC. Document review with Stage 2B Verification Checklist, included in Attachment A, or if the SDG is uploaded into eDMS, the verification checklist present in eDMS can be utilized. Data qualifiers generated during the validation process are entered into eDMS, as eDMS is the definitive source of data for generation of tables and figures for reporting purposes. Attachment B provides guidance for entering in qualifiers into eDMS.

Stage 2B validation (which includes all of the components of level III validation, regardless of client) will evaluate and consider the items listed above for completeness and Stage 2A validation, in addition to the following:

- Instrument Parameters
    - Counting Efficiency Calibration
    - Energy Calibration
    - Background Determination

4.3.1 Counting Efficiency Calibration

Use the appropriate checklist provided in this SOP or checklist in Data Review/Checklist module in eDMS, or equivalent checklist (for 3rd party data validation) for verification of the following:

1. Verify instrument's efficiency calibrations are present and were performed within frequency required in approved project plans (or laboratory SOP if not specified in the project plans). Qualify as estimated ("J/UJ") with the appropriate reason code those results associated with a batch with less than required efficiency calibration.
2. Verify daily efficiency performance checks were performed. Qualify as estimated ("J/UJ") with the appropriate reason code those results associated with a batch with missing efficiency performance checks.
3. Verify check source counting statistics are present. Qualify as estimated ("J/UJ") with the appropriate reason code those results associated with a batch with missing check source counting statistics.
4. Verify efficiency performance checks were performed daily prior to counting samples. Qualify as estimated ("J/UJ") with the appropriate reason code those results associated with a batch with missing performance checks.

4.3.2 Energy Calibration

Use the appropriate checklist provided in this SOP, or equivalent checklist (for 3rd party data validation) for verification of the following:

1. Verify instrument's energy calibrations performed within frequency required in approved project plans (or laboratory SOP if not specified in the project plans). Qualify as estimated ("J/UJ") with the appropriate reason code those results associated with a batch with missing energy calibration.

2. Verify energy performance checks performed daily prior to counting samples. Qualify as estimated ("J") with the appropriate reason code those results associated with a batch with missing energy performance checks.

4.3.3 Background Determination

Verify the following:

1. Verify background performance checks were performed at the required frequency identified in the approved project plans (or laboratory SOW if not specified in the project plans). Qualify as estimated ("J/UJ") with the appropriate reason code those results associated with a batch with missing background performance checks.

4.4 STAGE 3 VALIDATION

Stage 3 validation builds upon the validation conducted in Stages 2A and 2B, and involves the verification by calculation of instrument and sample results from the laboratory instrument responses, and comparison of recalculated results to laboratory reported results. Document review with Stage 3 Validation Checklist, included in Attachment A, or if the SDG is uploaded into eDMS, the validation checklist present in eDMS can be utilized.

4.4.1 Sample Specific Parameters

1. Verify chemical yield is within required limits. If greater than 110%, qualify the sample result as estimated (J) or unusable (R) based on the amount of bias allowed by the MQOs.
2. For sample results at or below the Lc (non-detect), verify by calculation each analyte's detectability. Estimate the Lc by multiplying the CSU by 1.65 (corresponding to 95% [2-sigma] probability). Qualify as estimated ("UJ") with the appropriate reason code those results with Lc < 1.65 times CSU. When appropriate background data (detector or blanks) is available, a more comprehensive evaluation of the Lc should be performed for those results qualified by the above calculation (see Section 4.7.2, ANSI/ANS-41.5-2012).
3. For sample results at or below the Lc (non-detect), determine whether the RDL has been met. Verify by calculation the CSU times 3.5 (corresponding to a 95% [2-sigma] probability) is less than or equal to ("≤") the RDL, or as otherwise stipulated in the approved project plans (or laboratory SOP if not specified in the project plans). Qualify as estimated ("UJ") with the appropriate reason code those results when 3.5 times CSU > RDL or as otherwise stipulated.
4. For sample results that are negative, evaluate results for excessive negative bias. Verify by calculation the absolute value of the negative result is less than ("<") 2 times the CSU, or as otherwise stipulated in the approved project plans (or laboratory SOP if not specified in the project plans). If absolute value of result is equal to or greater than 2 times CSU, qualify those results as estimated ("UJ") with the appropriate reason code.

4.4.2 Batch Control Parameters

1. For a subset of the LCS analyses (10% or as otherwise stipulated in the approved SAP), verify recoveries are calculated correctly (see Section 5.1.1, ANSI/ANS-41.5-2013):

$$\%D = \frac{\left|LCS_M - LCS_E\right|}{LCS_E} \times 100$$

where:

LCS_M = measured concentration of each analyte in the LCS
LCS_E = expected concentration of each analyte in the LCS

If the LCS is calculated incorrectly, contact the laboratory for corrected results.

2. For a subset of the MS analyses (10% or as otherwise stipulated in the approved SAP), verify recoveries are calculated correctly (see Section 5.2.1, ANSI/ANS-41.5-2013):

$$\%D = \frac{\left|SSR - SR - SA\right|}{SA} \times 100$$

where:

SSR = spiked sample result
SR = sample result
SA = amount of spike added.

If the MS is calculated incorrectly, contact the laboratory for corrected results.

3. For a subset of the duplicate and MSD results (10% or as otherwise stipulated in the approved SAP), verify calculations for RPD and DER (see Section 5.3.1, ANSI/ANS-41.5-2013).

$$RPD = \frac{\left|S - D\right|}{\left[\left(S + D\right) / 2\right]} \times 100$$

and

$$DER = \frac{\left|S - D\right|}{\sqrt{(CSU_S)^2 + (CSU_D)^2}}$$

where:

RPD = relative present difference
DER = duplicate error ratio
S = first sample value
D = second sample value
CSU_S = first sample CSU
CSU_D = second sample CSU

If the RPD or DER is calculated incorrectly, contact the laboratory for corrected results.

4. For a subset of the MB analyses (10% or as otherwise stipulated in the approved project plans), verify by calculation the MB is less than 1.65 x CSU and/or within control limits.

Qualify as estimated ("J/UJ") with the appropriate reason code those results with MB exceeding required limits.

4.4.3 Instrument Parameters

1. Evaluate whether the daily performance check results are within established tolerances [identified in the approved project plans (or laboratory SOP if not specified in the project plans)]. Qualify as estimated ("J/UJ") with the appropriate reason code those results associated with a batch with efficiency checks are outside accepted tolerances.
2. Evaluate whether the reported counting uncertainty was less than or equal to 1/5 of the MQO [identified in the approved project plans]. Qualify as estimated ("J/UJ") with the appropriate reason code those results associated with a batch with counting uncertainty outside acceptable criteria.
3. Verify the daily peak centroid or calculated energy for each peak in the performance check source or tolerance charts are within established tolerances identified in the approved project plans (or laboratory SOP if not specified in the project plans). Qualify as estimated ("J/UJ") with the appropriate reason code those results associated with a batch with energy calibration outside acceptable criteria.

4.4.4 Background Determination

Use the appropriate checklist provided in this SOP or in eDMS, or equivalent checklist (for 3rd party data validation) for verification of the following:

- Verify instrument's background was determined each time there was significant operational change and performed within frequency required in SAP (or laboratory SOW).
- Verify background performance check count-rate results are within established tolerances [identified in the SAP (or laboratory SOW)].
- Verify background performance check counting time was equal to or longer than sample counting time.

Qualify as estimated ("J") with the appropriate reason code those results associated with a batch with one or more of the above issues related to instrument background determination.

4.4.5 Quantitation and CSU

1. Verify raw data and calculations used in developing the results, MDA, and CSU were included in the results.
2. Verify procedures and equations used are consistent with method requirements (or laboratory SOP).
3. Verify dates and time intervals used in calculations are correct.
4. Review by calculation a subset of the quantitation calculations (10% of target analytes or as otherwise stipulated in the approved project plans).

4.5 STAGE 4 VALIDATION

Stage 4 validation builds upon the validation conducted in Stage 3. Stage 4 validation of the laboratory analytical data package consists of the Stage 3 validation plus the evaluation of instrument outputs. Document review with Stage 4 Validation Checklist, included in Attachment A, or if the SDG is uploaded into eDMS, the verification checklist present in eDMS can be utilized.

4.5.1 Nuclide Identification

1. Verify the raw spectral data and/or peak search and identification reports were included in the results.
2. Review raw spectral data for potential errors, including but not limited to: misidentification of peaks, nonlinear energy response or skewed spectral peak positions, and unresolved overlapping peak interference.
3. Review the resolution and centroid position of peak associated with radio tracer (alpha spectroscopy).
4. Verify by calculation detector resolution and energy calibration parameters of spectrometry systems and peak centroid energy.

5.0 REQUIRED DOCUMENTATION

The following records generated as a result of implementation of this procedure must be maintained as quality records.

- Narrative summary
- QRT
- DAR or DQAR (as required)
- Validation and Verification Checklists

6.0 ATTACHMENTS

A. Verification and Validation Checklists and Worksheets
B. Entering Qualifiers into eDMS

7.0 FORMS

None.

8.0 REFERENCES

American Nuclear Society (ANS), 2012. *Verification and Validation of Radiological Data for Use in Waste Management and Environmental Remediation*, ANS/ANSI-41.5-2012, Approved by the American National Standards Institute, Inc. (ANSI). February.

Innovative Technical Solutions, Inc. (ITSI), 2010. *Chemical Data Quality Management Plan (CDQMP)*, March.

U.S. Department of the Navy, Southwest Divsion (NAVFAC-SW), 2001. *Environmental Work Instruction #1, Data Validation Guidelines for Chemical Analysis of Environmental Samples*. 28 November.

U.S. Army Corps of Engineers (USACE), 2005. EM 200-1-10, *Guidance for Evaluating Performance-Based Chemical Data*. 30 June.

U.S. Environmental Protection Agency (USEPA), 2009. EPA 540-R-8-005, *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use.* January.

Attachments

Attachment A

Verification and Validation Checklists and Worksheets

Item No.	Review Questions	Yes/No/NA	Comment
E901.1 – Gamma Emitting Radionuclides in Drinking Water			
Stage 2B VEM			
1	Sampling/Login: COC - Custody Trail?		
2	Sampling/Login: COC - Temperature/Condition?		
3	Sampling/Login: COC - Receipt anomalies?		
4	Sampling/Login: COC - Sample/Methods checked?		
6	Sampling/Login: Samples - Collection date?		
7	ICAL: Calibration - Verification source when calculated with the new efficiency must be +- 10% of known value?		
8	ICAL: Full Width at the Half Maximum (FWHM) < +- 2 sigma or FWHM <= 3.0 keV at 1332 KeV or reference manufactures specifications?		
9	ICAL: Peak Shape - FWHM difference < 0.5 keV for selected peaks – one low end (ie: 241Am), one middle (ie: 60Co) and one high (ie: 137Cs)		
10	ICAL: Background - Monthly - Long count and Daily - Short count +- 3 sigma of measured population.		
11	ICAL: Background counting time was equal to or longer than sample counting time?		
12	CCV: Daily Verification - Verification +- 3 sigma?		
13	Analysis: Samples - Extraction date?		
14	Analysis: Samples - Analysis date?		
15	Analysis: Samples - Holding time?		
16	Analysis: Samples - Batching?		
17	Analysis: Samples - Lab qualifiers?		
18	Analysis: Blank - Method blank <MDA?		
19	Analysis: Blank - Equipment blank <MDA?		
20	Analysis: Precision/Accuracy - MS/MSD?		
21	Analysis: Precision/Accuracy - LCS/LCSD (75-125%)?		
22	Analysis: Precision/Accuracy - Laboratory Duplicates (Act. < 5*MDC then RPD < 100%, Act. > 5*MDC then < 20%RPD)?		
23	Analysis: Quantitation - PQLs (Lab RL < Project RL)?		
24	Analysis: Quantitation - MDA < required detection limit (RDL). Formula 3.5 * CSU <= RDL? If this is not true then: If the result is less than Lc and the result plus 1.65 times its uncertainty is greater than the action level,it shall be qualified as (J/UJ).		
25	Analysis: Quantitation - Sample Uncertainty (Negative results less than 2X TPU flagged "U", >2X TPU flagged "UJ"?		
26	Analysis: Quantitation - Dilution Factor?		
27	Analysis: Field Duplicates - RPD in criteria?		
E905.0 – Radioactive Strontium			
Stage 2B VEM			
1	Sampling/Login: COC - Custody Trail?		
2	Sampling/Login: COC - Temperature/Condition?		
3	Sampling/Login: COC - Receipt anomalies?		
4	Sampling/Login: COC - Sample/Methods checked?		
5	Sampling/Login: Case Narratives - Anomalies (DQFs)?		
6	Sampling/Login: Samples - Collection date?		
7	ICAL: Calibration - Verfication source when calculated with the new efficiency		

	must be +- 25% of known value?		
8	ICAL: Background frequency performed at required interval?		
9	ICAL: Daily (short count) Weekly (long count) Verification - Background Check +- 3 sigma		
10	ICAL: Background updated upon instrument/operational change?		
11	ICAL: Background counting time was equal to or longer than sample counting time?		
12	CCV: Daily Verification - Efficiency Check +- 3 sigma		
13	Analysis: Samples - Extraction date?		
14	Analysis: Samples - Analysis date?		
15	Analysis: Samples - Holding time?		
16	Analysis: Samples - Batching?		
17	Analysis: Samples - Lab qualifiers?		
18	Analysis: Blank - Method blank <MDA?		
19	Analysis: Blank - Equipment blank <MDA?		
20	Analysis: Precision/Accuracy - MS/MSD?		
21	Analysis: Precision/Accuracy - LCS/LCSD (75-125%)?		
22	Analysis: Precision/Accuracy - Tracers/Carriers (25-125%)?		
23	Analysis: Precision/Accuracy - Laboratory Duplicates (Act. < 5*MDC then RPD < 100%, Act. > 5*MDC then < 20%RPD or RER <= 3)?		
24	Analysis: Quantitation - PQLs (Lab RL < Project RL)?		
26	Analysis: Quantitation - Sample Uncertainty (Negative results less than 2X TPU flagged "U", >2X TPU flagged "UJ"?		
27	Analysis: Quantitation - Dilution Factor?		
28	Analysis: Field Duplicates - RPD in criteria?		
HASL 300 – Alpha, Beta or Gamma Radioassay			
Stage 2B VEM			
1	Stage 2 Review: COC - Custody Trail?		
2	Stage 2 Review: COC - Temperature/Condition?		
3	Stage 2 Review: COC - Receipt anomalies?		
4	Stage 2 Review: COC - Sample/Methods checked?		
5	Stage 2 Review: Case Narrative - Anomalies?		
6	Stage 2 Review: Samples - Collection date?		
7	Stage 2 Review: Samples - Extraction date?		
8	Stage 2 Review: Samples - Analysis date?		
9	Stage 2 Review: Samples - Holding time?		
10	Stage 2 Review: Calibration - ICAL?		
11	Stage 2 Review: Calibration - ICV?		
12	Stage 2 Review: Calibration - CCV?		
13	Stage 2 Review: Blank - Method blank?		
14	Stage 2 Review: Blank - Trip blank?		
15	Stage 2 Review: Blank - Equipment blank?		
16	Stage 2 Review: Tracer/Carrier recoveries within limits?		
17	Stage 2 Review: Precision/Accuracy - MS/MSD?		
18	Stage 2 Review: Precision/Accuracy - LCS/LCSD?		
19	Stage 2 Review: Precision - Duplicate RPD Acceptable?		
20	Stage 2 Review: Reporting Limits Acceptable?		
21	Stage 2 Review: System Performance Acceptable?		
22	Stage 2 Review: Analysis: Quantitation - Sample Uncertainty (Negative results less than 2X TPU flagged "U", >2X TPU flagged "UJ"?		
23	Stage 2 Review: Overall Assessment of data in SDG?		
E903 – Total Alpha-Emitting Radium Isotopes			
Stage 2B VEM			
1	Stage 2 Review: COC - Custody Trail?		

2	Stage 2 Review: COC - Temperature/Condition?		
3	Stage 2 Review: COC - Receipt anomalies?		
4	Stage 2 Review: COC - Sample/Methods checked?		
5	Stage 2 Review: Case Narrative - Anomalies?		
6	Stage 2 Review: Samples - Collection date?		
7	Stage 2 Review: Samples - Extraction date?		
8	Stage 2 Review: Samples - Analysis date?		
9	Stage 2 Review: Samples - Holding time?		
10	Stage 2 Review: Calibration - ICAL?		
11	Stage 2 Review: Calibration - ICV?		
12	Stage 2 Review: Calibration - CCV?		
13	Stage 2 Review: Blank - Method blank?		
14	Stage 2 Review: Blank - Equipment blank?		
15	Stage 2 Review: Tracer/Carrier recoveries within limits?		
16	Stage 2 Review: Precision/Accuracy - MS/MSD?		
17	Stage 2 Review: Precision/Accuracy - LCS/LCSD?		
18	Stage 2 Review: Precision - Duplicate RPD Acceptable?		
19	Stage 2 Review: Reporting Limits Acceptable?		
20	Stage 2 Review: System Performance Acceptable?		
21	Stage 2 Review: Sample Uncertainty Review (Between 2 and 3 Sigma J/UJ over 3 Sigma R/R)?		
22	Stage 2 Review: Overall Assessment of data in SDG?		
E904 – Radium 228			
Stage 2B VEM			
1	Stage 2 Review: COC - Custody Trail?		
2	Stage 2 Review: COC - Temperature/Condition?		
3	Stage 2 Review: COC - Receipt anomalies?		
4	Stage 2 Review: COC - Sample/Methods checked?		
5	Stage 2 Review: Case Narrative - Anomalies?		
6	Stage 2 Review: Samples - Collection date?		
7	Stage 2 Review: Samples - Extraction date?		
8	Stage 2 Review: Samples - Analysis date?		
9	Stage 2 Review: Samples - Holding time?		
10	Stage 2 Review: Calibration - ICAL?		
11	Stage 2 Review: Calibration - ICV?		
12	Stage 2 Review: Calibration - CCV?		
13	Stage 2 Review: Blank - Method blank?		
14	Stage 2 Review: Blank - Equipment blank?		
15	Stage 2 Review: Tracer/Carrier recoveries within limits?		
16	Stage 2 Review: Precision/Accuracy - MS/MSD?		
17	Stage 2 Review: Precision/Accuracy - LCS/LCSD?		
18	Stage 2 Review: Precision - Duplicate RPD Acceptable?		
19	Stage 2 Review: Reporting Limits Acceptable?		
20	Stage 2 Review: System Performance Acceptable?		
21	Stage 2 Review: Sample Uncertainty Review (Between 2 and 3 Sigma J/UJ over 3 Sigma R/R)?		
22	Stage 2 Review: Overall Assessment of data in SDG?		

Work Instruction

Calculating Toxic Equivalence (TEQ) for Dioxins, Furans and Dioxin-Like Compounds

Reviewed by: Kristen Carlyon, Senior Chemist Date: 27 Oct 2011

Approved by: Jeffrey Hess, Director Technical Services Date: 27 Oct 2011

Review / Revision History:

Version	Changes	Affects Section/Pages	Review/ Revision Date	Approval*
1.0	Initial release		27 Oct 2011	NA
1.1	Add references to updated EPA National Functional Guidelines for dioxins and furans	Pages 2 and 4	27 June 2012	J Hess
1.2	Updated new company information. No other changes made.	All	04 Mar 2015	J Hess

* Approval required for reviews and minor changes only. Substantive revisions to the technical requirements contained in the work instruction require review and approval by the signatures to the work instruction.

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1.0 PURPOSE AND SCOPE

The purpose of this work instruction is to describe the standard methodology for calculating the 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) toxic equivalency (TEQ). This methodology uses toxicity equivalence factors (TEFs) established for polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), and dioxin-like compounds (DLCs) by the World Health Organization (WHO) in 2005, and is consistent with U.S. Environmental Protection Agency (EPA) recommended practice.

There are several alternative methodologies for calculating the TEQ, some of which will be briefly discussed in this document. However, care should be taken in calculating TEQ using any of these alternative methodologies, and use of alternative methodologies should be clearly documented, including the rationale for use of the alternative methodology.

2.0 ACRONYMS AND DEFINITIONS

For purposes of this procedure, a number of terms and acronyms have the meanings defined below.

DLC: dioxin-like compound
EMPC: estimated maximum possible concentration
EDL: estimated detection limit
EQL: estimated quantitation limit
TCDD: 2,3,7,8-tetrachlorodibenzo-p-dioxin
TEF: toxicity equivalence factor
TEQ: toxic equivalency
PCDD: polychlorinated dibenzo-p-dioxin
PCDF: polychlorinated dibenzofuran
USEPA: U.S. Environmental Protection Agency
WHO: World Health Organization

3.0 BASIS OF CALCULATION

TEFs are published for seven 2,3,7,8-substituted isomers of PCDD's and ten 2,3,7,8-substituted isomers of PCDF's, and 12 polychlorinated biphenyls (PCBs) considered DLCs by WHO (2005) and recommended for use in human health risk assessment by EPA in *Recommended Toxicity Equivalence Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8- Tetrachlorodibenzo-p-dioxin and Dioxin-Like Compounds* (2010). For PCDDs/PCDFs, the TEF's are used to convert concentrations of the specific isomers to "equivalent" concentrations of TCDD, the sum of which represents the samples TEQ.

As noted in EPA Method 8280B (revision 2) for *PCDDs and PCDFs by High-Resolution Gas Chromatography/ Low-Resolution Mass Spectrometry (HRGC/LRMS)*, when calculating TEQ for a sample:

> …include only those 2,3,7,8-substituted isomers that were detected in the sample and met all of the qualitative identification criteria in Section 11.14.5. Do not include EMPC or EQL values in the TEQ calculation.

Section 11.14.5 of the method identifies a series of identification criteria that must be met for a peak to be "unambiguously identified" as a PCDD or PCDF. The criteria include: 1) retention times; 2) peak identification; 3) signal to noise ratio; 4) ion abundance ratios; and 5) other steps to minimize interference if the previous 4 steps are not met.

Further, as indicated in the *National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review* (EPA, 2005):

> When calculating the 2,3,7,8-TCDD TEF-adjusted concentration of a sample, the laboratory must include only those 2,3,7,8-substituted isomers that were detected in the sample and that met all of the qualitative identification criteria. The laboratory does not include Estimated Maximum Possible Concentration (EMPC) or Estimated Detection Limit (EDL) values in the TEF calculations.

The updated *National Functional Guidelines for CDDs and CDFs Data Review* (EPA, 2011) reaffirmed EPA's position on the above methodology, but added in the option of considering EMPCs or EDLs in the calculation of TEQ as surrogates for non-detect results, depending on regional policies. The methodology specified in this work instruction is consistent with the methodology specified for the analytical laboratories and as identified in XII (C)(1)(a) of the National Functional Guidelines (EPA, 2011).

The published TEFs as established by the WHO in 2005 are provided below. These are for mammals, there are separate TEFs for fish and birds, so make sure the correct TEFs are used when performing ecological risk assessments.

PCDDs

Compound	TEF
2,3,7,8-TCDD	1
1,2,3,7,8-PeCDD	1
1,2,3,4,7,8-HxCDD	0.1
1,2,3,6,7,8-HxCDD	0.1
1,2,3,7,8,9-HxCDD	0.1
1,2,3,4,6,7,8-HpCDD	0.01
OCDD	0.0003

PCDFs

Compound	TEF
2,3,7,8-TCDF	0.1
1,2,3,7,8-PeCDF	0.03
2,3,4,7,8-PeCDF	0.3
1,2,3,4,7,8-HxCDF	0.1
1,2,3,6,7,8-HxCDF	0.1
1,2,3,7,8,9-HxCDF	0.1
2,3,4,6,7,8-HxCDF	0.1
1,2,3,4,6,7,8-HpCDF	0.01
1,2,3,4,7,8,9-HpCDF	0.01
OCDF	0.0003

Non-*ortho*-substituted PCBs

Compound	TEF
3,3',4,4'-TCB (77)	0.0001
3,4,4',5-TCB (81)	0.0003
3,3',4,4',5-PeCB (126)	0.1
3,3',4,4',5,5'-HxCB (169)	0.03

Mono-*ortho*-substituted PCBs

Compound	TEF
2,3,3',4,4'-PeCB (105)	0.00003
2,3,4,4',5-PeCB (114)	0.00003
2,3',4,4',5-PeCB (118)	0.00003
2',3,4,4',5-PeCB (123)	0.00003
2,3,3',4,4',5-HXCB (156)	0.00003
2,3,3',4,4',5'-HxCB (157)	0.00003
2,3',4,4',5,5'-HxCB (167)	0.00003
2,3,3',4,4',5,5'-HpCB (189)	0.00003

4.0 CALCULATION METHOD

The TEQ is calculated by multiplying the reported value of the 2,3,7,8-substituted isomer by the corresponding TEF shown above, and then summing the resulting values. As noted above, the TEF should only be calculated for isomers that were detected and met all of the identification criteria identified in the analytical method; EMPC or EDL values should not be included in the calculation of TEQ.

An example calculation is shown below, with the shaded portion typical of the information the laboratory will provide:

Isomer	Result	EMPC	Qualifier	DL	LOQ	TEF	Isomer-specific TEQ
2,3,7,8-TCDD	ND		U	0.176	0.539	1	–
1,2,3,7,8-PeCDD	ND		U	0.367	2.69	1	–
1,2,3,4,7,8-HxCDD	0.500		J	0.420	2.69	0.1	0.05
1,2,3,6,7,8-HxCDD	3.76			0.445	2.69	0.1	0.376
1,2,3,7,8,9-HxCDD	1.87		J	0.438	2.69	0.1	0.187
1,2,3,4,6,7,8-HpCDD	133			1.13	2.69	0.01	1.33
OCDD	734			1.83	5.39	0.0003	0.2202
2,3,7,8-TCDF		0.511	J	0.240	0.539	0.1	–
1,2,3,7,8-PeCDF	ND		U	0.205	2.69	0.03	–
2,3,4,7,8-PeCDF	ND		U	0.199	2.69	0.3	–
1,2,3,4,7,8-HxCDF		0.433	J	0.259	2.69	0.1	–
1,2,3,6,7,8-HxCDF	ND		U	0.243	2.69	0.1	–
1,2,3,7,8,9-HxCDF		0.435	J	0.260	2.69	0.1	–
2,3,4,6,7,8-HxCDF	ND		U	0.296	2.69	0.1	–
1,2,3,4,6,7,8-HpCDF	3.17			0.274	2.69	0.01	0.0317
1,2,3,4,7,8,9-HpCDF	ND		U	0.354	2.69	0.01	–
OCDF	4.01		J	1.00	5.39	0.0003	0.001203
						Total TEQ:	2.20

PCDD and PCDF results are typically reported in pg/g, equivalent to parts per trillion (ppt).

5.0 DISCUSSION

Inclusion of non-detect and estimated results in TEQ calculations varies by regulatory agency and ultimate use of the results. While the above methodology is consistent with:

- EPA National Functional Guidelines (EPA, 2005)(EPA, 2011)
- EPA Region II Data Validation SOP (EPA, 2006)
- EPA Method 8280B (EPA, 2007)
- Bay Area Clean Water Agencies (BACWA) Guidance (BACWA, 2010)

Other jurisdictions (including EPA Region 4 [EPA, 2008]) include both estimated and non-detect values, with the EDLs being used for non-detect values. Additionally, the State of Florida methodology for calculating TEQ (Florida Department of Environmental Protection [FDEP], 2005) uses older 1997 WHO TEF values and ½ the method detection limit for non-detect values (based on FDEP's excel-based *Dioxin Conversion Table* at http://www.dep.state.fl.us/waste/quick_topics/publications/wc/DioxinConversionTable.xls).

6.0 REFERENCES

BACWA, 2010. *BACWA Guidance Document, Part II: Assessing Data Quality and Reporting Guidance for Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS By Method 1613 Revision B (October 1994),* March.

EPA, 2011. *National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDD's) and Chlorinated Dibenzofurans (CDF's) Data Review'.* EPA-540-R-11-016, September.

EPA, 2010. *Recommended Toxicity Equivalence Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8- Tetrachlorodibenzo-p-dioxin and Dioxin-Like Compounds*, EPA/100/R 10/005, December.

EPA, 2008. *Data Validation Standard Operating Procedures for Chlorinated Dioxin/Furan Analysis by High-Resolution Gas Chromatography/ High-Resolution Mass Spectrometry,* Revision 5, November.

EPA, 2007. *Method 8280B, Polychlorinated Dibenzo-p-Dioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by High-Resolution Gas Chromatography/ Low-Resolution Mass Spectrometry (HRGC/LRMS)*, Revision 2, February.

EPA, 2006. *USEPA Region II Data Validation SOP for EPA Method 1613, Revision B*, SOP HW-25, Revision 3, September.

EPA, 2005. *National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDD's) and Chlorinated Dibenzofurans (CDF's) Data Review'.* EPA-540-R-05-001, September.

FDEP, 2005. *Technical Report: Development of Cleanup Target Levels (CTLs) For Chapter 62-777, F.A.C,* February.

Van den Berg, et al, 2006. *The 2005 World Health Organization Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds*. Toxicological Sciences Volume 93, Issue 2, pp. 223-241, October.

ATTACHMENT B
DoD QSM Laboratory Limits

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Attachment B. DoD QSM Laboratory Limits
Sampling and Analysis Plan
IR Site 12 Remedial Design/Remedial Action
Former Naval Station Treasure Island
San Francisco, California

Method Description	Method Code	Analyte Description	CAS Number	RL	MDL	LOD	Units	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %	Surrogate Low	Surrogate High
Dioxins and Furans (HRGC/HRMS)	8290A_DOD5	2,3,7,8-TCDD	1746-01-6	1.00	0.150	0.400	pg/g	70	128	20	70	128	20		
		2,3,7,8-TCDF	51207-31-9	1.00	0.110	0.400	pg/g	75	135	20	75	135	20		
		1,2,3,7,8-PeCDD	40321-76-4	5.00	0.300	0.750	pg/g	74	125	20	74	125	20		
		1,2,3,7,8-PeCDF	57117-41-6	5.00	0.270	0.750	pg/g	77	131	20	77	131	20		
		2,3,4,7,8-PeCDF	57117-31-4	5.00	0.290	0.750	pg/g	75	128	20	75	128	20		
		1,2,3,4,7,8-HxCDD	39227-28-6	5.00	0.710	2.00	pg/g	72	131	20	72	131	20		
		1,2,3,6,7,8-HxCDD	57653-85-7	5.00	0.580	2.00	pg/g	74	134	20	74	134	20		
		1,2,3,7,8,9-HxCDD	19408-74-3	5.00	0.580	2.00	pg/g	71	138	20	71	138	20		
		1,2,3,4,7,8-HxCDF	70648-26-9	5.00	0.300	0.750	pg/g	77	130	20	77	130	20		
		1,2,3,6,7,8-HxCDF	57117-44-9	5.00	0.380	1.00	pg/g	73	134	20	73	134	20		
		1,2,3,7,8,9-HxCDF	72918-21-9	5.00	0.430	1.00	pg/g	74	135	20	74	135	20		
		2,3,4,6,7,8-HxCDF	60851-34-5	5.00	0.300	0.750	pg/g	74	133	20	74	133	20		
		1,2,3,4,6,7,8-HpCDD	35822-46-9	5.00	0.460	1.00	pg/g	76	125	20	76	125	20		
		1,2,3,4,6,7,8-HpCDF	67562-39-4	5.00	0.380	1.00	pg/g	73	135	20	73	135	20		
		1,2,3,4,7,8,9-HpCDF	55673-89-7	5.00	0.650	2.00	pg/g	72	131	20	72	131	20		
		OCDD	3268-87-9	10.0	1.50	4.00	pg/g	73	135	20	73	135	20		
		OCDF	39001-02-0	10.0	1.20	4.00	pg/g	66	144	20	66	144	20		
		13C-2,3,7,8-TCDD	76523-40-5	200		100	pg/g								
		13C-2,3,7,8-TCDF	89059-46-1	200		100	pg/g								
		13C-1,2,3,7,8-PeCDD	109719-79-1	200		100	pg/g								
		13C-1,2,3,7,8-PeCDF	109719-77-9	200		100	pg/g								
		13C-1,2,3,6,7,8-HxCDD	109719-81-5	200		100	pg/g								
		13C-1,2,3,4,7,8-HxCDF	114423-98-2	200		100	pg/g								
		13C-1,2,3,4,6,7,8-HpCDD	109719-83-7	200		100	pg/g								
		13C-1,2,3,4,6,7,8-HpCDF	109719-84-8	200		100	pg/g								
		13C-OCDD	114423-97-1	400		200	pg/g								
Metals (ICP)	6010C_DOD5	Lead	7439-92-1	1.00	0.250	0.750	mg/Kg	81	112	20	81	112	20		
Metals (ICP)	6010C_DOD5	Chromium	7440-47-3	1.00	0.250	0.750	mg/Kg	85	113	20	85	113	20		
Percent Moisture	Moisture	Percent Moisture	STL00177	0.100		0.100	%								
		Percent Solids	STL00234	0.100		0.100	%								
Radium-226 & Other Gamma Emitters (GS)	GA_01_R_Ra	Actinium-227	14952-40-0				pCi/g								
		Actinium 228	14331-83-0				pCi/g								
		Americium-241	14596-10-2				pCi/g	87	116	40					
		Bismuth-212	14913-49-6				pCi/g								
		Bismuth-214	14733-03-0				pCi/g								
		Cesium-137	10045-97-3				pCi/g	87	120	40					

Method Description	Method Code	Analyte Description	CAS Number	RL	MDL	LOD	Units	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %	Surrogate Low	Surrogate High
		Cobalt-60	10198-40-0				pCi/g	87	115	40					
		Lead-210	14255-04-0				pCi/g								
		Lead-212	15092-94-1				pCi/g								
		Lead-214	15067-28-4				pCi/g								
		Potassium-40	13966-00-2				pCi/g								
		Protactinium-231	14331-85-2				pCi/g								
		Radium-226	13982-63-3	1.00			pCi/g								
		Radium-228	15262-20-1				pCi/g								
		Thallium-208	14913-50-9				pCi/g								
		Thorium-232	7440-29-1				pCi/g								
		Th-234	15065-10-8				pCi/g								
		Uranium-235	15117-96-1				pCi/g								
		Uranium-238	7440-61-1				pCi/g								
		Thorium 228	14274-82-9				pCi/g								
Semivolatile Organic Compounds (GC/MS SIM)	8270D_SIM_DOD5	Acenaphthene	83-32-9	0.00500	0.000470	0.00100	mg/Kg	44	111	20	44	111	20		
		Anthracene	120-12-7	0.00500	0.000395	0.00100	mg/Kg	50	114	20	50	114	20		
		Benzo[a]anthracene	56-55-3	0.00500	0.000303	0.00100	mg/Kg	54	122	20	54	122	20		
		Benzo[a]pyrene	50-32-8	0.00500	0.000399	0.00100	mg/Kg	50	125	20	50	125	20		
		Benzo[b]fluoranthene	205-99-2	0.00500	0.000505	0.00200	mg/Kg	53	128	20	53	128	20		
		Benzo[g,h,i]perylene	191-24-2	0.00500	0.00100	0.00300	mg/Kg	49	127	20	49	127	20		
		Benzo[k]fluoranthene	207-08-9	0.00500	0.000760	0.00200	mg/Kg	56	123	20	56	123	20		
		Chrysene	218-01-9	0.00500	0.000347	0.00100	mg/Kg	57	118	20	57	118	20		
		Dibenz(a,h)anthracene	53-70-3	0.00500	0.00120	0.00300	mg/Kg	50	129	20	50	129	20		
		Fluoranthene	206-44-0	0.00500	0.000293	0.00100	mg/Kg	55	119	20	55	119	20		
		Fluorene	86-73-7	0.00500	0.000490	0.00100	mg/Kg	47	114	20	47	114	20		
		Indeno[1,2,3-cd]pyrene	193-39-5	0.00500	0.000479	0.00100	mg/Kg	49	130	20	49	130	20		
		Naphthalene	91-20-3	0.00500	0.000307	0.00100	mg/Kg	38	111	20	38	111	20		
		Pyrene	129-00-0	0.00500	0.000350	0.00100	mg/Kg	55	117	20	55	117	20		
		2-Fluorobiphenyl (Surr)	321-60-8	0.00500	0.000250	0.00100	mg/Kg							46	115
		Nitrobenzene-d5	4165-60-0	0.00500	0.000250	0.00100	mg/Kg							44	125
		Terphenyl-d14	1718-51-0	0.00500	0.000250	0.00100	mg/Kg							58	133
Polychlorinated Biphenyls (PCBs) by Gas Chromatography	8082A_DOD5	Aroclor 1016	12674-11-2	0.0330	0.00340	0.0100	mg/Kg	47	134	30	47	134	30		
		Aroclor 1221	11104-28-2	0.0330	0.00520	0.0150	mg/Kg								
		Aroclor 1232	11141-16-5	0.0330	0.00640	0.0200	mg/Kg								
		Aroclor 1242	53469-21-9	0.0330	0.00740	0.0200	mg/Kg								
		Aroclor 1248	12672-29-6	0.0330	0.00570	0.0150	mg/Kg								
		Aroclor 1254	11097-69-1	0.0330	0.00270	0.0100	mg/Kg								
		Aroclor 1260	11096-82-5	0.0330	0.00290	0.0100	mg/Kg	53	140	30	53	140	30		

Method Description	Method Code	Analyte Description	CAS Number	RL	MDL	LOD	Units	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %	Surrogate Low	Surrogate High
		DCB Decachlorobiphenyl	2051-24-3	0.00500	0.00167	0.00500	mg/Kg							60	125
Organochlorine Pesticides (GC)	8081B_DOD5	alpha-BHC	319-84-6	0.00170	0.000220	0.000500	mg/Kg	45	137	30	45	137	30		
		4,4'-DDD	72-54-8	0.00170	0.000260	0.000500	mg/Kg	56	139	30	56	139	30		
		DCB Decachlorobiphenyl	2051-24-3	0.00170	0.000500	0.00170	mg/Kg	49	119	30	49	119		49	119
		Tetrachloro-m-xylene	877-09-8	0.00170	0.000500	0.00170	mg/Kg	42	129	30	42	129	30	42	129
Metals (ICP)	6020A_DOD5	Antimony	7440-36-0	0.5	0.2	0.4	mg/Kg	72	124	20	72	124	20		
		Arsenic	7440-38-2	1	0.4	0.8	mg/Kg	82	118	20	82	118	20		
		Barium	7440-39-3	2	0.5	1	mg/Kg	86	116	20	86	116	20		
		Beryllium	7440-41-7	0.1	0.04	0.08	mg/Kg	80	120	20	80	120	20		
		Cadmium	7440-43-9	0.05	0.024	0.048	mg/Kg	84	116	20	84	116	20		
		Chromium	7440-47-3	1	0.45	0.9	mg/Kg	83	119	20	83	119	20		
		Cobalt	7440-48-4	0.2	0.075	0.15	mg/Kg	84	115	20	84	115	20		
		Copper	7440-50-8	1	0.4	0.8	mg/Kg	84	119	20	84	119	20		
		Lead	7439-92-1	0.3	0.125	0.25	mg/Kg	84	118	20	84	118	20		
		Molybdenum	7439-98-7	0.5	0.2	0.4	mg/Kg	83	114	20	83	114	20		
		Nickel	7440-02-0	0.5	0.2	0.4	mg/Kg	84	119	20	84	119	20		
		Selenium	7782-49-2	0.5	0.32	0.4	mg/Kg	80	119	20	80	119	20		
		Silver	7440-22-4	0.2	0.075	0.15	mg/Kg	83	118	20	83	118	20		
		Thallium	7440-28-0	0.5	0.2	0.4	mg/Kg	83	118	20	83	118	20		
		Vanadium	7440-62-2	1	0.4	0.8	mg/Kg	82	116	20	82	116	20		
		Zinc	7440-66-6	5	2	4	mg/Kg	82	119	20	82	119	20		
Mercury (CVAA)	7471B_DOD5	Mercury	7439-97-6	0.0330	0.0110	0.0300	mg/Kg	80	124	20	80	124	30		
Percent Moisture	Moisture	Percent Moisture	STL00177	0.100		0.100	%								
		Percent Solids	STL00234	0.100		0.100	%								
pH	9045D	pH adj. to 25 deg C	STL00204	0.100		0.100	SU	98	102	10					
Volatile Organic Compounds (GC/MS)	8260C_DOD5	1,1,1,2-Tetrachloroethane	630-20-6	0.00500	0.000410	0.00100	mg/Kg	78	125	20	78	125	20		
		1,1,1-Trichloroethane	71-55-6	0.00500	0.000360	0.00100	mg/Kg	73	130	20	73	130	20		
		1,1,2,2-Tetrachloroethane	79-34-5	0.00500	0.000680	0.00200	mg/Kg	70	124	20	70	124	20		
		1,1,2-Trichloroethane	79-00-5	0.00500	0.000440	0.00100	mg/Kg	78	121	20	78	121	20		
		1,1-Dichloroethane	75-34-3	0.00500	0.000290	0.00100	mg/Kg	76	125	20	76	125	20		
		1,1-Dichloroethene	75-35-4	0.00500	0.000260	0.00100	mg/Kg	70	131	20	70	131	20		
		1,2,3-Trichlorobenzene	87-61-6	0.00500	0.000750	0.00200	mg/Kg	66	130	20	66	130	20		
		1,2,4-Trichlorobenzene	120-82-1	0.00500	0.000750	0.00200	mg/Kg	67	129	20	67	129	20		
		1,2,4-Trimethylbenzene	95-63-6	0.00500	0.000510	0.00200	mg/Kg	75	123	20	75	123	20		

Method Description	Method Code	Analyte Description	CAS Number	RL	MDL	LOD	Units	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %	Surrogate Low	Surrogate High
		1,2-Dibromo-3-Chloropropa	96-12-8	0.0100	0.000880	0.00200	mg/Kg	61	132	20	61	132	20		
		1,2-Dibromoethane (EDB)	106-93-4	0.0100	0.000270	0.00100	mg/Kg	78	122	20	78	122	20		
		1,2-Dichlorobenzene	95-50-1	0.00500	0.000640	0.00200	mg/Kg	78	121	20	78	121	20		
		1,2-Dichloroethane	107-06-2	0.00500	0.000730	0.00200	mg/Kg	73	128	20	73	128	20		
		1,2-Dichloropropane	78-87-5	0.00500	0.000600	0.00200	mg/Kg	76	123	20	76	123	20		
		1,3,5-Trimethylbenzene	108-67-8	0.00500	0.000350	0.00100	mg/Kg	73	124	20	73	124	20		
		1,3-Dichlorobenzene	541-73-1	0.00500	0.000300	0.00100	mg/Kg	77	121	20	77	121	20		
		1,3-Dichloropropane	142-28-9	0.00500	0.000570	0.00200	mg/Kg	77	121	20	77	121	20		
		1,4-Dichlorobenzene	106-46-7	0.00500	0.000780	0.00200	mg/Kg	75	120	20	75	120	20		
		2-Butanone	78-93-3	0.0100	0.00140	0.00500	mg/Kg	51	148	20	51	148	20		
		2-Chlorotoluene	95-49-8	0.00500	0.000620	0.00200	mg/Kg	75	122	20	75	122	20		
		2-Hexanone	591-78-6	0.0100	0.000740	0.00200	mg/Kg	53	145	20	53	145	20		
		4-Chlorotoluene	106-43-4	0.00500	0.000860	0.00200	mg/Kg	72	124	20	72	124	20		
		4-Methyl-2-pentanone	108-10-1	0.0100	0.000920	0.00200	mg/Kg	65	135	20	65	135	20		
		Acetone	67-64-1	0.0200	0.00140	0.00500	mg/Kg	36	164	20	36	164	20		
		Benzene	71-43-2	0.00500	0.000260	0.00100	mg/Kg	77	121	20	77	121	20		
		Bromobenzene	108-86-1	0.00500	0.000520	0.00200	mg/Kg	78	121	20	78	121	20		
		Bromochloromethane	74-97-5	0.00500	0.000940	0.00200	mg/Kg	78	125	20	78	125	20		
		Bromodichloromethane	75-27-4	0.00500	0.000530	0.00200	mg/Kg	75	127	20	75	127	20		
		Bromoform	75-25-2	0.00500	0.000400	0.00100	mg/Kg	67	132	20	67	132	20		
		Bromomethane	74-83-9	0.00500	0.000860	0.00200	mg/Kg	53	143	20	53	143	20		
		Carbon disulfide	75-15-0	0.0100	0.000490	0.00100	mg/Kg	63	132	20	63	132	20		
		Carbon tetrachloride	56-23-5	0.00500	0.000530	0.00200	mg/Kg	70	135	20	70	135	20		
		Chlorobenzene	108-90-7	0.00500	0.000290	0.00100	mg/Kg	79	120	20	79	120	20		
		Chloroform	67-66-3	0.00500	0.000260	0.00100	mg/Kg	78	123	20	78	123	20		
		Chloromethane	74-87-3	0.00500	0.000500	0.00100	mg/Kg	50	136	20	50	136	20		
		cis-1,2-Dichloroethene	156-59-2	0.00500	0.000890	0.00200	mg/Kg	77	123	20	77	123	20		
		cis-1,3-Dichloropropene	10061-01-5	0.00500	0.000640	0.00200	mg/Kg	74	126	20	74	126	20		
		Dibromochloromethane	124-48-1	0.00500	0.000260	0.00100	mg/Kg	74	126	20	74	126	20		
		Dibromomethane	74-95-3	0.00500	0.000580	0.00200	mg/Kg	78	125	20	78	125	20		
		Dichlorodifluoromethane	75-71-8	0.00500	0.000890	0.00200	mg/Kg	29	149	20	29	149	20		
		Ethylbenzene	100-41-4	0.00500	0.000340	0.00100	mg/Kg	76	122	20	76	122	20		
		Hexachlorobutadiene	87-68-3	0.00500	0.000330	0.00100	mg/Kg	61	135	20	61	135	20		
		m,p-Xylenes	179601-23-1	0.00500	0.000810	0.00200	mg/Kg	77	124	20	77	124	20		
		Methylene Chloride	75-09-2	0.00500	0.000840	0.00200	mg/Kg	70	128	20	70	128	20		
		Methyl-tert-butyl Ether (MTE	1634-04-4	0.00500	0.000600	0.00200	mg/Kg	73	125	20	73	125	20		
		o-Xylene	95-47-6	0.00500	0.000330	0.00100	mg/Kg	77	123	20	77	123	20		
		Styrene	100-42-5	0.00500	0.000310	0.00100	mg/Kg	76	124	20	76	124	20		
		Tetrachloroethene	127-18-4	0.00500	0.000610	0.00200	mg/Kg	73	128	20	73	128	20		
		Toluene	108-88-3	0.00500	0.000610	0.00200	mg/Kg	77	121	20	77	121	20		
		trans-1,2-Dichloroethene	156-60-5	0.00500	0.000380	0.00100	mg/Kg	74	125	20	74	125	20		
		Trichloroethene	79-01-6	0.00500	0.000600	0.00200	mg/Kg	77	123	20	77	123	20		
		Trichlorofluoromethane	75-69-4	0.00500	0.000340	0.00100	mg/Kg	62	140	20	62	140	20		
		Vinyl chloride	75-01-4	0.00500	0.000360	0.00100	mg/Kg	56	135	20	56	135	20		
		Xylenes, Total	1330-20-7	0.00500	0.000810	0.00150	mg/Kg	78	124	20	78	124	20		
		1,2-Dichloroethane-d4 (Surr	17060-07-0	0.00500	0.00100	0.00500	mg/Kg	71	136	20	71	136	20	71	136
		4-Bromofluorobenzene (Sur	460-00-4	0.00500	0.00100	0.00500	mg/Kg	79	119	20	79	119	20	79	119

Method Description	Method Code	Analyte Description	CAS Number	RL	MDL	LOD	Units	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %	Surrogate Low	Surrogate High
		Dibromofluoromethane (Sur	1868-53-7	0.00500	0.00100	0.00500	mg/Kg	78	119	20	78	119	20	78	119
		Toluene-d8 (Surr)	2037-26-5	0.00500	0.00100	0.00500	mg/Kg	85	116	20	85	116	20	85	116
Semivolatile Organic Compounds (GC/MS SIM)	8270D_SIM_DOD5	Acenaphthene	83-32-9	0.00500	0.000470	0.00100	mg/Kg	44	111	20	44	111	20		
		Anthracene	120-12-7	0.00500	0.000395	0.00100	mg/Kg	50	114	20	50	114	20		
		Benzo[a]anthracene	56-55-3	0.00500	0.000303	0.00100	mg/Kg	54	122	20	54	122	20		
		Benzo[a]pyrene	50-32-8	0.00500	0.000399	0.00100	mg/Kg	50	125	20	50	125	20		
		Benzo[b]fluoranthene	205-99-2	0.00500	0.000505	0.00200	mg/Kg	53	128	20	53	128	20		
		Benzo[g,h,i]perylene	191-24-2	0.00500	0.00100	0.00300	mg/Kg	49	127	20	49	127	20		
		Benzo[k]fluoranthene	207-08-9	0.00500	0.000760	0.00200	mg/Kg	56	123	20	56	123	20		
		Chrysene	218-01-9	0.00500	0.000347	0.00100	mg/Kg	57	118	20	57	118	20		
		Dibenz(a,h)anthracene	53-70-3	0.00500	0.00120	0.00300	mg/Kg	50	129	20	50	129	20		
		Fluoranthene	206-44-0	0.00500	0.000293	0.00100	mg/Kg	55	119	20	55	119	20		
		Fluorene	86-73-7	0.00500	0.000490	0.00100	mg/Kg	47	114	20	47	114	20		
		Indeno[1,2,3-cd]pyrene	193-39-5	0.00500	0.000479	0.00100	mg/Kg	49	130	20	49	130	20		
		Naphthalene	91-20-3	0.00500	0.000307	0.00100	mg/Kg	38	111	20	38	111	20		
		Phenanthrene	85-01-8	0.00500	0.000350	0.00100	mg/Kg	49	113	20	49	113	20		
		Pyrene	129-00-0	0.00500	0.000350	0.00100	mg/Kg	55	117	20	55	117	20		
		2-Fluorobiphenyl (Surr)	321-60-8	0.00500	0.000250	0.00100	mg/Kg							46	115
		Nitrobenzene-d5	4165-60-0	0.00500	0.000250	0.00100	mg/Kg							44	125
		Terphenyl-d14	1718-51-0	0.00500	0.000250	0.00100	mg/Kg							58	133
Polychlorinated Biphenyls (PCBs) by Gas Chromatography	8082A_DOD5	Aroclor 1016	12674-11-2	0.0330	0.00340	0.0100	mg/Kg	47	134	30	47	134	30		
		Aroclor 1221	11104-28-2	0.0330	0.00520	0.0150	mg/Kg								
		Aroclor 1232	11141-16-5	0.0330	0.00640	0.0200	mg/Kg								
		Aroclor 1242	53469-21-9	0.0330	0.00740	0.0200	mg/Kg								
		Aroclor 1248	12672-29-6	0.0330	0.00570	0.0150	mg/Kg								
		Aroclor 1254	11097-69-1	0.0330	0.00270	0.0100	mg/Kg								
		Aroclor 1260	11096-82-5	0.0330	0.00290	0.0100	mg/Kg	53	140	30	53	140	30		
		DCB Decachlorobiphenyl	2051-24-3	0.00500	0.00167	0.00500	mg/Kg							60	125
Organochlorine Pesticides (GC)	8081B_DOD5	4,4'-DDD	72-54-8	0.00170	0.000260	0.000500	mg/Kg	56	139	30	56	139	30		
		4,4'-DDE	72-55-9	0.00170	0.000220	0.000500	mg/Kg	56	134	30	56	134	30		
		4,4'-DDT	50-29-3	0.00170	0.000400	0.00100	mg/Kg	50	141	30	50	141	30		
		Aldrin	309-00-2	0.00170	0.000210	0.000500	mg/Kg	45	136	30	45	136	30		
		alpha-BHC	319-84-6	0.00170	0.000220	0.000500	mg/Kg	45	137	30	45	137	30		
		beta-BHC	319-85-7	0.00170	0.000330	0.00100	mg/Kg	50	136	30	50	136	30		
		Chlordane (technical)	12789-03-6	0.0250	0.00850	0.0200	mg/Kg	43	149	30	43	149	30		

Method Description	Method Code	Analyte Description	CAS Number	RL	MDL	LOD	Units	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %	Surrogate Low	Surrogate High
		Dieldrin	60-57-1	0.00170	0.0000910	0.000270	mg/Kg	56	136	30	56	136	30		
		Endosulfan I	959-98-8	0.00170	0.000100	0.000270	mg/Kg	53	132	30	53	132	30		
		Endosulfan II	33213-65-9	0.00170	0.000100	0.000270	mg/Kg	53	134	30	53	134	30		
		Endrin	72-20-8	0.00170	0.000110	0.000270	mg/Kg	57	140	30	57	140	30		
		.gamma.-BHC	58-89-9	0.00170	0.000170	0.000500	mg/Kg	49	135	30	49	135	30		
		Heptachlor	76-44-8	0.00170	0.000190	0.000500	mg/Kg	47	136	30	47	136	30		
		Heptachlor epoxide	1024-57-3	0.00170	0.000120	0.000270	mg/Kg	52	136	30	52	136	30		
		Methoxychlor	72-43-5	0.00340	0.00130	0.00300	mg/Kg	52	143	30	52	143	30		
		Toxaphene	8001-35-2	0.0670	0.0200	0.0500	mg/Kg	33	141	30	33	141	30		
		DCB Decachlorobiphenyl	2051-24-3	0.00170	0.000500	0.00170	mg/Kg	49	119	30	49	119		49	119
		Tetrachloro-m-xylene	877-09-8	0.00170	0.000500	0.00170	mg/Kg	42	129	30	42	129	30	42	129
Diesel Range Organics (DRO) (GC)	8015B_DRO_ DOD5	Diesel Range Organics (C1	STL00096	2.00	0.500	1.00	mg/Kg	38	132	30	38	132	30		
		Motor Oil Range Organics (	STL00158	20.0	3.77	10.0	mg/Kg								
		o-Terphenyl (Surr)	84-15-1				mg/Kg							45	130
Volatile Organic Compounds by GC/MS	8260_CALUFT _DOD	Gasoline Range Organics (	STL00061	0.500	0.0500	0.200	mg/Kg	79	123	30	79	123	30		
		4-Bromofluorobenzene (Sur	460-00-4				mg/Kg							70	131
Semivolatile Organic Compounds (GC/MS)	8270D_DOD5	2,4,5-Trichlorophenol	95-95-4	0.330	0.0830	0.167	mg/Kg	41	124	20	41	124	20		
		2,4,6-Trichlorophenol	88-06-2	0.330	0.0840	0.167	mg/Kg	39	126	20	39	126	20		
		2,4-Dichlorophenol	120-83-2	0.330	0.0890	0.167	mg/Kg	40	122	20	40	122	20		
		2,4-Dimethylphenol	105-67-9	0.500	0.167	0.333	mg/Kg								
		2,4-Dinitrophenol	51-28-5	2.00	0.214	0.333	mg/Kg	10	60	20	10	60	20		
		2,4-Dinitrotoluene	121-14-2	0.330	0.0890	0.167	mg/Kg	48	126	20	48	126	20		
		2,6-Dinitrotoluene	606-20-2	0.330	0.0990	0.167	mg/Kg	46	124	20	46	124	20		
		2-Chloronaphthalene	91-58-7	0.330	0.0810	0.167	mg/Kg	41	114	20	41	114	20		
		2-Chlorophenol	95-57-8	0.330	0.0880	0.167	mg/Kg	34	121	20	34	121	20		
		2-Methylnaphthalene	91-57-6	0.330	0.0850	0.167	mg/Kg	38	122	20	38	122	20		
		2-Methylphenol	95-48-7	0.330	0.0580	0.167	mg/Kg	32	122	20	32	122	20		
		2-Nitroaniline	88-74-4	1.60	0.0840	0.333	mg/Kg	44	127	20	44	127	20		
		3/4-Methylphenol	15831-10-4	1.00	0.330	0.660	mg/Kg	34	119	20	34	119	20		
		3,3'-Dichlorobenzidine	91-94-1	1.60	0.0940	0.167	mg/Kg	22	121	20	22	121	20		
		4-Chloroaniline	106-47-8	0.330	0.0580	0.167	mg/Kg	17	106	20	17	106	20		
		4-Nitroaniline	100-01-6	1.60	0.0880	0.167	mg/Kg	63	109	20	63	109	20		
		Benzoic acid	65-85-0	1.60	0.289	0.660	mg/Kg	10	97	20	10	97	20		
		Benzyl alcohol	100-51-6	0.510	0.170	0.367	mg/Kg	29	122	20	29	122	20		
		Bis(2-chloroethoxy)methane	111-91-1	0.330	0.0880	0.167	mg/Kg	36	121	20	36	121	20		
		Bis(2-chloroethyl)ether	111-44-4	0.330	0.0810	0.167	mg/Kg	31	120	20	31	120	20		

Method Description	Method Code	Analyte Description	CAS Number	RL	MDL	LOD	Units	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %	Surrogate Low	Surrogate High
		Bis(2-ethylhexyl) phthalate	117-81-7	0.330	0.0980	0.167	mg/Kg	51	133	20	51	133	20		
		Dibenzofuran	132-64-9	0.330	0.0860	0.167	mg/Kg	44	120	20	44	120	20		
		Diethylphthalate	84-66-2	0.330	0.0900	0.167	mg/Kg	50	124	20	50	124	20		
		Dimethylphthalate	131-11-3	0.330	0.0870	0.167	mg/Kg	48	124	20	48	124	20		
		Di-n-butyl phthalate	84-74-2	0.330	0.0970	0.167	mg/Kg	51	128	20	51	128	20		
		Di-n-octyl phthalate	117-84-0	0.330	0.0970	0.167	mg/Kg	45	140	20	45	140	20		
		Hexachlorobenzene	118-74-1	0.330	0.0890	0.167	mg/Kg	45	122	20	45	122	20		
		Hexachlorobutadiene	87-68-3	0.330	0.0820	0.167	mg/Kg	32	123	20	32	123	20		
		Hexachloroethane	67-72-1	0.330	0.0810	0.167	mg/Kg	28	117	20	28	117	20		
		Isophorone	78-59-1	0.330	0.0930	0.167	mg/Kg	30	122	20	30	122	20		
		Nitrobenzene	98-95-3	0.330	0.0760	0.167	mg/Kg	34	122	20	34	122	20		
		N-Nitrosodimethylamine	62-75-9	0.330	0.0960	0.167	mg/Kg	23	120	20	23	120	20		
		Pentachlorophenol	87-86-5	1.60	0.0510	0.167	mg/Kg	25	133	20	25	133	20		
		Phenol	108-95-2	0.330	0.0830	0.167	mg/Kg	34	121	20	34	121	20		
		2,4,6-Tribromophenol (Surr)	118-79-6	3.30	0.100	3.30	mg/Kg	39	132					39	132
		2-Fluorobiphenyl (Surr)	321-60-8	3.30	0.100	3.30	mg/Kg	44	115					44	115
		2-Fluorophenol (Surr)	367-12-4	3.30	0.100	3.30	mg/Kg	35	115					35	115
		Nitrobenzene-d5 (Surr)	4165-60-0	3.30	0.100	3.30	mg/Kg	37	122					37	122
		Phenol-d5 (Surr)	4165-62-2	3.30	0.100	3.30	mg/Kg	33	122					33	122
		Terphenyl-d14 (Surr)	1718-51-0	3.30	0.100	3.30	mg/Kg	54	127					54	127
Metals (ICP/MS)	6020A_DOD5	Aluminum	7429-90-5	50.0	20.0	40.0	ug/L	84	117	20	84	117	20		
		Antimony	7440-36-0	5.00	2.00	4.00	ug/L	85	117	20	85	117	20		
		Arsenic	7440-38-2	10.0	4.00	8.00	ug/L	84	116	20	84	116	20		
		Barium	7440-39-3	2.00	0.900	1.80	ug/L	86	114	20	86	114	20		
		Beryllium	7440-41-7	0.500	0.200	0.400	ug/L	83	121	20	83	121	20		
		Cadmium	7440-43-9	0.500	0.200	0.400	ug/L	87	115	20	87	115	20		
		Calcium	7440-70-2	100	45.0	90.0	ug/L	87	118	20	87	118	20		
		Chromium	7440-47-3	10.0	4.00	8.00	ug/L	85	116	20	85	116	20		
		Cobalt	7440-48-4	2.00	0.900	1.80	ug/L	86	115	20	86	115	20		
		Copper	7440-50-8	3.00	1.90	2.50	ug/L	85	118	20	85	118	20		
		Iron	7439-89-6	50.0	20.0	40.0	ug/L	87	118	20	87	118	20		
		Lead	7439-92-1	3.00	1.00	2.00	ug/L	88	115	20	88	115	20		
		Magnesium	7439-95-4	50.0	20.0	40.0	ug/L	83	118	20	83	118	20		
		Manganese	7439-96-5	2.00	0.900	1.80	ug/L	87	115	20	87	115	20		
		Molybdenum	7439-98-7	5.00	2.00	4.00	ug/L	83	115	20	83	115	20		
		Nickel	7440-02-0	5.00	2.00	4.00	ug/L	85	117	20	85	117	20		
		Potassium	7440-09-7	100	45.0	90.0	ug/L	87	115	20	87	115	20		
		Selenium	7782-49-2	5.00	2.00	4.00	ug/L	80	120	20	80	120	20		
		Silver	7440-22-4	2.00	0.900	1.80	ug/L	85	116	20	85	116	20		
		Sodium	7440-23-5	100	45.0	90.0	ug/L	85	117	20	85	117	20		
		Thallium	7440-28-0	2.00	0.900	1.80	ug/L	82	116	20	82	116	20		
		Vanadium	7440-62-2	10.0	4.00	8.00	ug/L	86	115	20	86	115	20		
		Zinc	7440-66-6	20.0	7.50	15.0	ug/L	83	119	20	83	119	20		

Method Description	Method Code	Analyte Description	CAS Number	RL	MDL	LOD	Units	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %	Surrogate Low	Surrogate High
Mercury (CVAA)	7470A_DOD5	Mercury	7439-97-6	0.200	0.0600	0.150	ug/L	82	119	20	82	119	20		
Metals (ICP/MS)	6020A_DOD5	Aluminum	7429-90-5	50.0	20.0	40.0	ug/L	84	117	20	84	117	20		
		Antimony	7440-36-0	5.00	2.00	4.00	ug/L	85	117	20	85	117	20		
		Arsenic	7440-38-2	10.0	4.00	8.00	ug/L	84	116	20	84	116	20		
		Barium	7440-39-3	2.00	0.900	1.80	ug/L	86	114	20	86	114	20		
		Beryllium	7440-41-7	0.500	0.200	0.400	ug/L	83	121	20	83	121	20		
		Cadmium	7440-43-9	0.500	0.200	0.400	ug/L	87	115	20	87	115	20		
		Calcium	7440-70-2	100	45.0	90.0	ug/L	87	118	20	87	118	20		
		Chromium	7440-47-3	10.0	4.00	8.00	ug/L	85	116	20	85	116	20		
		Cobalt	7440-48-4	2.00	0.900	1.80	ug/L	86	115	20	86	115	20		
		Copper	7440-50-8	3.00	1.90	2.50	ug/L	85	118	20	85	118	20		
		Iron	7439-89-6	50.0	20.0	40.0	ug/L	87	118	20	87	118	20		
		Lead	7439-92-1	3.00	1.00	2.00	ug/L	88	115	20	88	115	20		
		Magnesium	7439-95-4	50.0	20.0	40.0	ug/L	83	118	20	83	118	20		
		Manganese	7439-96-5	2.00	0.900	1.80	ug/L	87	115	20	87	115	20		
		Molybdenum	7439-98-7	5.00	2.00	4.00	ug/L	83	115	20	83	115	20		
		Nickel	7440-02-0	5.00	2.00	4.00	ug/L	85	117	20	85	117	20		
		Potassium	7440-09-7	100	45.0	90.0	ug/L	87	115	20	87	115	20		
		Selenium	7782-49-2	5.00	2.00	4.00	ug/L	80	120	20	80	120	20		
		Silver	7440-22-4	2.00	0.900	1.80	ug/L	85	116	20	85	116	20		
		Sodium	7440-23-5	100	45.0	90.0	ug/L	85	117	20	85	117	20		
		Thallium	7440-28-0	2.00	0.900	1.80	ug/L	82	116	20	82	116	20		
		Vanadium	7440-62-2	10.0	4.00	8.00	ug/L	86	115	20	86	115	20		
		Zinc	7440-66-6	20.0	7.50	15.0	ug/L	83	119	20	83	119	20		
Mercury (CVAA)	7470A_DOD5	Mercury	7439-97-6	0.200	0.0600	0.150	ug/L	82	119	20	82	119	20		
Radium-226 (GFPC)	903.0	Radium-226	13982-63-3	1.00			pCi/L	68	137	40	75	138	40		
		Ba Carrier	7440-39-3				g							40	110
Solids, Total Dissolved (TDS)	2540C_Calcd	Total Dissolved Solids	STL00242	10.0	5.40	10.0	mg/L	80	120	20	85	115	20		
Solids, Total Suspended (TSS)	2540D	Total Suspended Solids	STL00161	5.00	5.00	5.00	mg/L	85	115	20					
Anions, Ion Chromatography	300_ORGFM_28D	Sulfate	14808-79-8	1.00	0.0490	0.150	mg/L	90	110	10	90	110	10		

Attachment B. DoD QSM Laboratory Limits
Sampling and Analysis Plan
IR Site 12 Remedial Design/Remedial Action
Former Naval Station Treasure Island
San Francisco, California

Method Description	Method Code	Analyte Description	CAS Number	RL	MDL	LOD	Units	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %	Surrogate Low	Surrogate High
Volatile Organic Compounds by GC/MS	8260_CALUFT_DOD	Gasoline Range Organics ((	STL00061	0.0500	0.0150	0.0300	mg/L	78	118	23	78	118	23		
		4-Bromofluorobenzene (Sur	460-00-4				mg/L							73	115

Method Description	Method Code	Analyte Description	CAS Number	RL	MDL	LOD	Units	LCS - Low	LCS - High	LCS - RPD %	MS - Low	MS - High	MS - RPD %	Surrogate Low	Surrogate High
Diesel Range Organics (DRO) (GC)	8015B_DRO_DOD5	Diesel Range Organics (C1	STL00096	0.0500	0.0160	0.0400	mg/L	36	132	30	36	132	30		
		Motor Oil Range Organics (	STL00158	0.500	0.166	0.400	mg/L								
		o-Terphenyl (Surr)	84-15-1				mg/L							56	125

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ATTACHMENT C
Laboratory Standard Operating Procedures

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NOTIFICATION: **THIS PAGE CONTAINS SENSITIVE BUT UNCLASSIFIED INFORMATION WHICH IS PROTECTED BY THE FREEDOM OF INFORMATION ACT**

FOIA Exemption 4 (5 USC 552(b)(4))
Privileged/confidential trade secrets, commercial, financial information

Pages 435 to 951

YOU MAY APPEAL THIS DECISION

Based on the redaction, this constitutes a partial denial of your request. Because your request has been denied in part, you are advised of your right to appeal this determination in writing.

Please refer to the accompanying correspondence from the FOIA Office for directions and information about the appeal process.

ATTACHMENT D
Laboratory DoD ELAP Certificates

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CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board
500 Montgomery Street, Suite 625, Alexandria, VA 22314, 877-344-3044

This is to certify that

TestAmerica Laboratories
St. Louis Facility
13715 Rider Trail North
Earth City, Missouri 63045

has been assessed by ANAB
and meets the requirements of international standard

ISO/IEC 17025:2005

and DoD Quality Systems Manual for Environmental Laboratories (DoD QSM V 5.1)

while demonstrating technical competence in the fields of

TESTING

Refer to the accompanying Scope of Accreditation for information regarding the types of calibrations and/or tests to which this accreditation applies.

L2305
Certificate Number

ANAB Approval

Certificate Valid: 03/21/2018-04/06/2019
Version No. 001 Issued: 03/21/2018

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

ANSI-ASQ National Accreditation Board

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005 AND DOD QUALITY SYSTEMS MAUAL FOR ENVIRONMENTAL LABORATORIES (DOD QSM V5.1)

TestAmerica Laboratories
St. Louis Facility
13715 Rider Trail North
Earth City, Missouri 63045
Marti Ward
314-298-8566

TESTING

Valid to: **April 6, 2019** Certificate Number: **L2305**

Environmental

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-AES	EPA 6010B/6010C/6010D	Aluminum
ICP-AES	EPA 6010B/6010C/6010D	Antimony
ICP-AES	EPA 6010B/6010C/6010D	Arsenic
ICP-AES	EPA 6010B/6010C/6010D	Barium
ICP-AES	EPA 6010B/6010C/6010D	Beryllium
ICP-AES	EPA 6010B/6010C/6010D	Bismuth
ICP-AES	EPA 6010B/6010C/6010D	Boron
ICP-AES	EPA 6010B/6010C/6010D	Cadmium
ICP-AES	EPA 6010B/6010C/6010D	Calcium
ICP-AES	EPA 6010B/6010C/6010D	Chromium
ICP-AES	EPA 6010B/6010C/6010D	Cobalt
ICP-AES	EPA 6010B/6010C/6010D	Copper
ICP-AES	EPA 6010B/6010C/6010D	Iron
ICP-AES	EPA 6010B/6010C/6010D	Lead
ICP-AES	EPA 6010B/6010C/6010D	Lithium
ICP-AES	EPA 6010B/6010C/6010D	Magnesium

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-AES	EPA 6010B/6010C/6010D	Manganese
ICP-AES	EPA 6010B/6010C/6010D	Molybdenum
ICP-AES	EPA 6010B/6010C/6010D	Nickel
ICP-AES	EPA 6010B/6010C/6010D	Phosphorus
ICP-AES	EPA 6010B/6010C/6010D	Potassium
ICP-AES	EPA 6010B/6010C/6010D	Selenium
ICP-AES	EPA 6010B/6010C/6010D	Silicon
ICP-AES	EPA 6010B/6010C/6010D	Silver
ICP-AES	EPA 6010B/6010C/6010D	Sodium
ICP-AES	EPA 6010B/6010C/6010D	Strontium
ICP-AES	EPA 6010B/6010C/6010D	Sulfur
ICP-AES	EPA 6010B/6010C/6010D	Thallium
ICP-AES	EPA 6010B/6010C/6010D	Thorium
ICP-AES	EPA 6010B/6010C/6010D	Tin
ICP-AES	EPA 6010B/6010C/6010D	Titanium
ICP-AES	EPA 6010B/6010C/6010D	Vanadium
ICP-AES	EPA 6010B/6010C/6010D	Zinc
GC/MS	EPA 8260B/8260C	Acetone
GC/MS	EPA 8260B/8260C	Acetonitrile
GC/MS	EPA 8260B/8260C	Acrolein
GC/MS	EPA 8260B/8260C	Acrylonitrile
GC/MS	EPA 8260B/8260C	Benzene
GC/MS	EPA 8260B/8260C	Benzyl chloride
GC/MS	EPA 8260B/8260C	Bromobenzene
GC/MS	EPA 8260B/8260C	Bromochloromethane
GC/MS	EPA 8260B/8260C	Bromodichloromethane
GC/MS	EPA 8260B/8260C	Bromoform
GC/MS	EPA 8260B/8260C	Bromomethane
GC/MS	EPA 8260B/8260C	n-Butanol
GC/MS	EPA 8260B/8260C	2-Butanone
GC/MS	EPA 8260B/8260C	n-Butylbenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/8260C	sec-Butylbenzene
GC/MS	EPA 8260B/8260C	tert-Butylbenzene
GC/MS	EPA 8260B/8260C	Carbon disulfide
GC/MS	EPA 8260B/8260C	Carbon tetrachloride
GC/MS	EPA 8260B/8260C	Chlorobenzene
GC/MS	EPA 8260B/8260C	2-Chloro-1,3-butadiene
GC/MS	EPA 8260B/8260C	Chlorodibromomethane
GC/MS	EPA 8260B/8260C	Chloroethane
GC/MS	EPA 8260B/8260C	2-Chloroethyl vinyl ether
GC/MS	EPA 8260B/8260C	Chloroform
GC/MS	EPA 8260B/8260C	Chloromethane
GC/MS	EPA 8260B/8260C	Allyl chloride
GC/MS	EPA 8260B/8260C	2-Chlorotoluene
GC/MS	EPA 8260B/8260C	4-Chlorotoluene
GC/MS	EPA 8260B/8260C	Cyclohexane
GC/MS	EPA 8260B/8260C	Cyclohexanone
GC/MS	EPA 8260B/8260C	1,2-Dibromo-3-chloropropane
GC/MS	EPA 8260B/8260C	1,2-Dibromoethane
GC/MS	EPA 8260B/8260C	Dibromomethane
GC/MS	EPA 8260B/8260C	1,2-Dichlorobenzene
GC/MS	EPA 8260B/8260C	1,3-Dichlorobenzene
GC/MS	EPA 8260B/8260C	1,4-Dichlorobenzene
GC/MS	EPA 8260B/8260C	trans-1,4-Dichloro-2-butene
GC/MS	EPA 8260B/8260C	Dichlorodifluoromethane
GC/MS	EPA 8260B/8260C	1,1-Dichloroethane
GC/MS	EPA 8260B/8260C	1,2-Dichloroethane
GC/MS	EPA 8260B/8260C	cis-1,2-Dichloroethene
GC/MS	EPA 8260B/8260C	trans-1,2-Dichloroethene
GC/MS	EPA 8260B/8260C	1,1-Dichloroethene
GC/MS	EPA 8260B/8260C	1,2-Dichloroethene (total)
GC/MS	EPA 8260B/8260C	1,2-Dichloropropane

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/8260C	1,3-Dichloropropane
GC/MS	EPA 8260B/8260C	2,2-Dichloropropane
GC/MS	EPA 8260B/8260C	cis-1,3-Dichloropropene
GC/MS	EPA 8260B/8260C	trans-1,3-Dichloropropene
GC/MS	EPA 8260B/8260C	1,1-Dichloropropene
GC/MS	EPA 8260B/8260C	1,2-Dichloro-1,1,2,2-tetrafluoroethane
GC/MS	EPA 8260B/8260C	Dimethyl disulfide
GC/MS	EPA 8260B/8260C	1,4-Dioxane
GC/MS	EPA 8260B/8260C	Ethyl acetate
GC/MS	EPA 8260B/8260C	Ethylbenzene
GC/MS	EPA 8260B/8260C	Ethyl ether
GC/MS	EPA 8260B/8260C	Diethyl ether
GC/MS	EPA 8260B/8260C	Ethyl methacrylate
GC/MS	EPA 8260B/8260C	Freon 113
GC/MS	EPA 8260B/8260C	Hexachlorobutadiene
GC/MS	EPA 8260B/8260C	n-Hexane
GC/MS	EPA 8260B/8260C	2-Hexanone
GC/MS	EPA 8260B/8260C	Iodomethane
GC/MS	EPA 8260B/8260C	Isobutanol
GC/MS	EPA 8260B/8260C	Isopropylbenzene
GC/MS	EPA 8260B/8260C	p-Isopropyltoluene
GC/MS	EPA 8260B/8260C	Methacrylonitrile
GC/MS	EPA 8260B/8260C	Methyl acetate
GC/MS	EPA 8260B/8260C	Methylcyclohexane
GC/MS	EPA 8260B/8260C	Methylene chloride
GC/MS	EPA 8260B/8260C	Methyl methacrylate
GC/MS	EPA 8260B/8260C	4-Methyl-2-pentanone
GC/MS	EPA 8260B/8260C	MTBE
GC/MS	EPA 8260B/8260C	Naphthalene
GC/MS	EPA 8260B/8260C	2-Nitropropane
GC/MS	EPA 8260B/8260C	Nonanal

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Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/8260C	Pentachloroethane
GC/MS	EPA 8260B/8260C	Propionitrile
GC/MS	EPA 8260B/8260C	n-Propylbenzene
GC/MS	EPA 8260B/8260C	Styrene
GC/MS	EPA 8260B/8260C	1,1,1,2-Tetrachloroethane
GC/MS	EPA 8260B/8260C	1,1,2,2-Tetrachloroethane
GC/MS	EPA 8260B/8260C	Tetrachloroethene
GC/MS	EPA 8260B/8260C	Tetrahydrofuran
GC/MS	EPA 8260B/8260C	Toluene
GC/MS	EPA 8260B/8260C	1,3,5-Trichlorobenzene
GC/MS	EPA 8260B/8260C	1,2,3-Trichlorobenzene
GC/MS	EPA 8260B/8260C	1,2,4-Trichlorobenzene
GC/MS	EPA 8260B/8260C	1,1,1-Trichloroethane
GC/MS	EPA 8260B/8260C	1,1,2-Trichloroethane
GC/MS	EPA 8260B/8260C	Trichloroethene
GC/MS	EPA 8260B/8260C	Trichlorofluoromethane
GC/MS	EPA 8260B/8260C	1,2,3-Trichloropropane
GC/MS	EPA 8260B/8260C	1,1,2-Trichloro-1,2,2-trifluoroethane
GC/MS	EPA 8260B/8260C	Trichlorotrifluoroethane
GC/MS	EPA 8260B/8260C	1,2,4-Trimethylbenzene
GC/MS	EPA 8260B/8260C	1,3,5-Trimethylbenzene
GC/MS	EPA 8260B/8260C	Vinyl acetate
GC/MS	EPA 8260B/8260C	Vinyl chloride
GC/MS	EPA 8260B/8260C	m-Xylene & p-Xylene
GC/MS	EPA 8260B/8260C	o-Xylene
GC/MS	EPA 8260B/8260C	Xylenes (total)
GC/MS	EPA 8260B/8260C SIM	1,4-Dioxane
GC/MS	EPA 624	Acetone
GC/MS	EPA 624	Acetonitrile
GC/MS	EPA 624	Acrolein
GC/MS	EPA 624	Acrylonitrile

ANSI-ASQ National Accreditation Board

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 624	Benzene
GC/MS	EPA 624	Benzyl chloride
GC/MS	EPA 624	Bromobenzene
GC/MS	EPA 624	Bromochloromethane
GC/MS	EPA 624	Bromodichloromethane
GC/MS	EPA 624	Bromoform
GC/MS	EPA 624	Bromomethane
GC/MS	EPA 624	n-Butanol
GC/MS	EPA 624	2-Butanone
GC/MS	EPA 624	n-Butylbenzene
GC/MS	EPA 624	sec-Butylbenzene
GC/MS	EPA 624	tert-Butylbenzene
GC/MS	EPA 624	Carbon disulfide
GC/MS	EPA 624	Carbon tetrachloride
GC/MS	EPA 624	Chlorobenzene
GC/MS	EPA 624	2-Chloro-1,3-butadiene
GC/MS	EPA 624	Chlorodibromomethane
GC/MS	EPA 624	Chloroethane
GC/MS	EPA 624	2-Chloroethyl vinyl ether
GC/MS	EPA 624	Chloroform
GC/MS	EPA 624	Chloromethane
GC/MS	EPA 624	Allyl chloride
GC/MS	EPA 624	2-Chlorotoluene
GC/MS	EPA 624	4-Chlorotoluene
GC/MS	EPA 624	Cyclohexane
GC/MS	EPA 624	Cyclohexanone
GC/MS	EPA 624	1,2-Dibromo-3-chloropropane
GC/MS	EPA 624	1,2-Dibromoethane
GC/MS	EPA 624	Dibromomethane
GC/MS	EPA 624	1,2-Dichlorobenzene
GC/MS	EPA 624	1,3-Dichlorobenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 624	1,4-Dichlorobenzene
GC/MS	EPA 624	trans-1,4-Dichloro-2-butene
GC/MS	EPA 624	Dichlorodifluoromethane
GC/MS	EPA 624	1,1-Dichloroethane
GC/MS	EPA 624	1,2-Dichloroethane
GC/MS	EPA 624	cis-1,2-Dichloroethene
GC/MS	EPA 624	trans-1,2-Dichloroethene
GC/MS	EPA 624	1,1-Dichloroethene
GC/MS	EPA 624	1,2-Dichloroethene (total)
GC/MS	EPA 624	1,2-Dichloropropane
GC/MS	EPA 624	1,3-Dichloropropane
GC/MS	EPA 624	2,2-Dichloropropane
GC/MS	EPA 624	cis-1,3-Dichloropropene
GC/MS	EPA 624	trans-1,3-Dichloropropene
GC/MS	EPA 624	1,1-Dichloropropene
GC/MS	EPA 624	1,2-Dichloro-1,1,2,2-tetrafluoroethane
GC/MS	EPA 624	Dimethyl disulfide
GC/MS	EPA 624	1,4-Dioxane
GC/MS	EPA 624	Ethyl acetate
GC/MS	EPA 624	Ethylbenzene
GC/MS	EPA 624	Ethyl ether
GC/MS	EPA 624	Diethyl ether
GC/MS	EPA 624	Ethyl methacrylate
GC/MS	EPA 624	Freon 113
GC/MS	EPA 624	Hexachlorobutadiene
GC/MS	EPA 624	n-Hexane
GC/MS	EPA 624	2-Hexanone
GC/MS	EPA 624	Iodomethane
GC/MS	EPA 624	Isobutanol
GC/MS	EPA 624	Isopropylbenzene
GC/MS	EPA 624	p-Isopropyltoluene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 624	Methacrylonitrile
GC/MS	EPA 624	Methyl acetate
GC/MS	EPA 624	Methylcyclohexane
GC/MS	EPA 624	Methylene chloride
GC/MS	EPA 624	Methyl methacrylate
GC/MS	EPA 624	4-Methyl-2-pentanone
GC/MS	EPA 624	MTBE
GC/MS	EPA 624	Naphthalene
GC/MS	EPA 624	2-Nitropropane
GC/MS	EPA 624	Nonanal
GC/MS	EPA 624	Pentachloroethane
GC/MS	EPA 624	Propionitrile
GC/MS	EPA 624	n-Propylbenzene
GC/MS	EPA 624	Styrene
GC/MS	EPA 624	1,1,1,2-Tetrachloroethane
GC/MS	EPA 624	1,1,2,2-Tetrachloroethane
GC/MS	EPA 624	Tetrachloroethene
GC/MS	EPA 624	Tetrahydrofuran
GC/MS	EPA 624	Toluene
GC/MS	EPA 624	1,3,5-Trichlorobenzene
GC/MS	EPA 624	1,2,3-Trichlorobenzene
GC/MS	EPA 624	1,2,4-Trichlorobenzene
GC/MS	EPA 624	1,1,1-Trichloroethane
GC/MS	EPA 624	1,1,2-Trichloroethane
GC/MS	EPA 624	Trichloroethene
GC/MS	EPA 624	Trichlorofluoromethane
GC/MS	EPA 624	1,2,3-Trichloropropane
GC/MS	EPA 624	1,1,2-Trichloro-1,2,2-trifluoroethane
GC/MS	EPA 624	Trichlorotrifluoroethane
GC/MS	EPA 624	1,2,4-Trimethylbenzene
GC/MS	EPA 624	1,3,5-Trimethylbenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 624	Vinyl acetate
GC/MS	EPA 624	Vinyl chloride
GC/MS	EPA 624	m-Xylene & p-Xylene
GC/MS	EPA 624	o-Xylene
GC/MS	EPA 624	Xylenes (total)
GC/MS	EPA 8270C/8270D	Acenaphthene
GC/MS	EPA 8270C/8270D	Acenaphthylene
GC/MS	EPA 8270C/8270D	Acetophenone
GC/MS	EPA 8270C/8270D	2-Acetylaminofluorene
GC/MS	EPA 8270C/8270D	4-Aminobiphenyl
GC/MS	EPA 8270C/8270D	Aniline
GC/MS	EPA 8270C/8270D	Anthracene
GC/MS	EPA 8270C/8270D	Aramite (total)
GC/MS	EPA 8270C/8270D	Atrazine
GC/MS	EPA 8270C/8270D	Azobenzene
GC/MS	EPA 8270C/8270D	Benzaldehyde
GC/MS	EPA 8270C/8270D	Benzidine
GC/MS	EPA 8270C/8270D	Benzo(a)anthracene
GC/MS	EPA 8270C/8270D	Benzo(b)fluoranthene
GC/MS	EPA 8270C/8270D	Benzo(k)fluoranthene
GC/MS	EPA 8270C/8270D	Benzoic acid
GC/MS	EPA 8270C/8270D	Benzo(ghi)perylene
GC/MS	EPA 8270C/8270D	Benzo(a)pyrene
GC/MS	EPA 8270C/8270D	Benzyl alcohol
GC/MS	EPA 8270C/8270D	1,1'-Biphenyl
GC/MS	EPA 8270C/8270D	bis(2-Chloroethoxy)methane
GC/MS	EPA 8270C/8270D	bis(2-Chloroethyl) ether
GC/MS	EPA 8270C/8270D	bis(2-Chloroisopropyl) ether
GC/MS	EPA 8270C/8270D	bis(2-Ethylhexyl) phthalate
GC/MS	EPA 8270C/8270D	4-Bromophenyl phenyl ether
GC/MS	EPA 8270C/8270D	n-Butylbenzenesulfonamide
GC/MS	EPA 8270C/8270D	Butyl benzyl phthalate

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/8270D	Caprolactam
GC/MS	EPA 8270C/8270D	Carbazole
GC/MS	EPA 8270C/8270D	4-Chloroaniline
GC/MS	EPA 8270C/8270D	Chlorobenzilate
GC/MS	EPA 8270C/8270D	p-Chlorobenzilate
GC/MS	EPA 8270C/8270D	4-Chloro-3-methylphenol
GC/MS	EPA 8270C/8270D	2-Chloronaphthalene
GC/MS	EPA 8270C/8270D	2-Chlorophenol
GC/MS	EPA 8270C/8270D	4-Chlorophenyl phenyl ether
GC/MS	EPA 8270C/8270D	Chrysene
GC/MS	EPA 8270C/8270D	Cresols (total)
GC/MS	EPA 8270C/8270D	Cyclohexanol
GC/MS	EPA 8270C/8270D	Diallate
GC/MS	EPA 8270C/8270D	Dibenzo(a,h)anthracene
GC/MS	EPA 8270C/8270D	Dibenzofuran
GC/MS	EPA 8270C/8270D	Di-n-butyl phthalate
GC/MS	EPA 8270C/8270D	1,2-Dichlorobenzene
GC/MS	EPA 8270C/8270D	1,3-Dichlorobenzene
GC/MS	EPA 8270C/8270D	1,4-Dichlorobenzene
GC/MS	EPA 8270C/8270D	3,3'-Dichlorobenzidine
GC/MS	EPA 8270C/8270D	2,4-Dichlorophenol
GC/MS	EPA 8270C/8270D	2,6-Dichlorophenol
GC/MS	EPA 8270C/8270D	Diethyl phthalate
GC/MS	EPA 8270C/8270D	O,O-Diethyl-O-(2-pyrazinyl) phosphorothioate
GC/MS	EPA 8270C/8270D	Dimethoate
GC/MS	EPA 8270C/8270D	p-Dimethylaminoazobenzene
GC/MS	EPA 8270C/8270D	7,12-Dimethylbenz(a)anthracene
GC/MS	EPA 8270C/8270D	3,3'-Dimethylbenzidine
GC/MS	EPA 8270C/8270D	Dimethylformamide
GC/MS	EPA 8270C/8270D	alpha,alpha-Dimethylphenethylamine
GC/MS	EPA 8270C/8270D	2,4-Dimethylphenol
GC/MS	EPA 8270C/8270D	Dimethyl phthalate

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/8270D	1,3-Dinitrobenzene
GC/MS	EPA 8270C/8270D	1,4-Dinitrobenzene
GC/MS	EPA 8270C/8270D	4,6-Dinitro-2-methylphenol
GC/MS	EPA 8270C/8270D	2,4-Dinitrophenol
GC/MS	EPA 8270C/8270D	2,4-Dinitrotoluene
GC/MS	EPA 8270C/8270D	2,6-Dinitrotoluene
GC/MS	EPA 8270C/8270D	2-sec-Butyl-4,6-dinitrophenol
GC/MS	EPA 8270C/8270D	Dinoseb
GC/MS	EPA 8270C/8270D	Di-n-octyl phthalate
GC/MS	EPA 8270C/8270D	1,4-Dioxane
GC/MS	EPA 8270C/8270D	1,2-Diphenylhydrazine (as Azobenzene)
GC/MS	EPA 8270C/8270D	Disulfoton
GC/MS	EPA 8270C/8270D	Ethyl methacrylate
GC/MS	EPA 8270C/8270D	Ethyl methanesulfonate
GC/MS	EPA 8270C/8270D	Famphur
GC/MS	EPA 8270C/8270D	Fluoranthene
GC/MS	EPA 8270C/8270D	Fluorene
GC/MS	EPA 8270C/8270D	Hexachlorobenzene
GC/MS	EPA 8270C/8270D	Hexachlorobutadiene
GC/MS	EPA 8270C/8270D	Hexachlorocyclopentadiene
GC/MS	EPA 8270C/8270D	Hexachloroethane
GC/MS	EPA 8270C/8270D	Hexachlorophene
GC/MS	EPA 8270C/8270D	Hexachloropropene
GC/MS	EPA 8270C/8270D	Indeno(1,2,3-cd)pyrene
GC/MS	EPA 8270C/8270D	Isodrin
GC/MS	EPA 8270C/8270D	Isophorone
GC/MS	EPA 8270C/8270D	Isosafrole
GC/MS	EPA 8270C/8270D	Kepone
GC/MS	EPA 8270C/8270D	Methapyrilene
GC/MS	EPA 8270C/8270D	2-Methylbenzenamine
GC/MS	EPA 8270C/8270D	3-Methylcholanthrene
GC/MS	EPA 8270C/8270D	4,4'-Methylenebis(2-chloroaniline)

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/8270D	Methyl methacrylate
GC/MS	EPA 8270C/8270D	Methyl methanesulfonate
GC/MS	EPA 8270C/8270D	2-Methylnaphthalene
GC/MS	EPA 8270C/8270D	Methyl parathion
GC/MS	EPA 8270C/8270D	2-Methylphenol
GC/MS	EPA 8270C/8270D	3-Methylphenol & 4-Methylphenol
GC/MS	EPA 8270C/8270D	2-Methylphenol, 3-methylphenol and 4-methylphenol
GC/MS	EPA 8270C/8270D	Methylphenols (total)
GC/MS	EPA 8270C/8270D	Naphthalene
GC/MS	EPA 8270C/8270D	1,4-Naphthoquinone
GC/MS	EPA 8270C/8270D	1-Naphthylamine
GC/MS	EPA 8270C/8270D	2-Naphthylamine
GC/MS	EPA 8270C/8270D	2-Nitroaniline
GC/MS	EPA 8270C/8270D	3-Nitroaniline
GC/MS	EPA 8270C/8270D	4-Nitroaniline
GC/MS	EPA 8270C/8270D	Nitrobenzene
GC/MS	EPA 8270C/8270D	2-Nitrophenol
GC/MS	EPA 8270C/8270D	4-Nitrophenol
GC/MS	EPA 8270C/8270D	4-Nitroquinoline-1-oxide
GC/MS	EPA 8270C/8270D	N-Nitrosodi-n-butylamine
GC/MS	EPA 8270C/8270D	N-Nitrosodiethylamine
GC/MS	EPA 8270C/8270D	N-Nitrosodimethylamine
GC/MS	EPA 8270C/8270D	N-Nitrosodiphenylamine
GC/MS	EPA 8270C/8270D	N-Nitrosodi-n-propylamine
GC/MS	EPA 8270C/8270D	N-Nitrosomethylethylamine
GC/MS	EPA 8270C/8270D	N-Nitrosomorpholine
GC/MS	EPA 8270C/8270D	N-Nitrosopiperidine
GC/MS	EPA 8270C/8270D	N-Nitrosopyrrolidine
GC/MS	EPA 8270C/8270D	5-Nitro-o-toluidine
GC/MS	EPA 8270C/8270D	2,2'-oxybis(1-Chloropropane)
GC/MS	EPA 8270C/8270D	Parathion
GC/MS	EPA 8270C/8270D	Pentachlorobenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/8270D	Pentachloroethane
GC/MS	EPA 8270C/8270D	Pentachloronitrobenzene
GC/MS	EPA 8270C/8270D	Pentachlorophenol
GC/MS	EPA 8270C/8270D	Phenacetin
GC/MS	EPA 8270C/8270D	Phenanthrene
GC/MS	EPA 8270C/8270D	Phenol
GC/MS	EPA 8270C/8270D	p-Phenylene diamine
GC/MS	EPA 8270C/8270D	Phorate
GC/MS	EPA 8270C/8270D	2-Picoline
GC/MS	EPA 8270C/8270D	Pronamide
GC/MS	EPA 8270C/8270D	Pyrene
GC/MS	EPA 8270C/8270D	Pyridine
GC/MS	EPA 8270C/8270D	Safrole
GC/MS	EPA 8270C/8270D	Sulfotepp
GC/MS	EPA 8270C/8270D	1,2,4,5-Tetrachlorobenzene
GC/MS	EPA 8270C/8270D	2,3,4,6-Tetrachlorophenol
GC/MS	EPA 8270C/8270D	Tetraethyldithiopyrophosphate (Sulfotepp)
GC/MS	EPA 8270C/8270D	Thionazin
GC/MS	EPA 8270C/8270D	o-Toluidine
GC/MS	EPA 8270C/8270D	Tributyl phosphate
GC/MS	EPA 8270C/8270D	1,2,4-Trichlorobenzene
GC/MS	EPA 8270C/8270D	2,4,5-Trichlorophenol
GC/MS	EPA 8270C/8270D	2,4,6-Trichlorophenol
GC/MS	EPA 8270C/8270D	O,O,O-Triethyl phosphorothioate
GC/MS	EPA 8270C/8270D	1,3,5-Trinitrobenzene
GC/MS	EPA 8270C/8270D	Tris(2-chloroethyl)phosphate
GC/MS	EPA 8270C/8270D	1-Methyl naphthalene
GC/MS	EPA 625	Acenaphthene
GC/MS	EPA 625	Acenaphthylene
GC/MS	EPA 625	Acetophenone
GC/MS	EPA 625	2-Acetylaminofluorene
GC/MS	EPA 625	4-Aminobiphenyl

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 625	Aniline
GC/MS	EPA 625	Anthracene
GC/MS	EPA 625	Aramite (total)
GC/MS	EPA 625	Atrazine
GC/MS	EPA 625	Azobenzene
GC/MS	EPA 625	Benzaldehyde
GC/MS	EPA 625	Benzidine
GC/MS	EPA 625	Benzo(a)anthracene
GC/MS	EPA 625	Benzo(b)fluoranthene
GC/MS	EPA 625	Benzo(k)fluoranthene
GC/MS	EPA 625	Benzoic acid
GC/MS	EPA 625	Benzo(ghi)perylene
GC/MS	EPA 625	Benzo(a)pyrene
GC/MS	EPA 625	Benzyl alcohol
GC/MS	EPA 625	1,1'-Biphenyl
GC/MS	EPA 625	bis(2-Chloroethoxy)methane
GC/MS	EPA 625	bis(2-Chloroethyl) ether
GC/MS	EPA 625	bis(2-Chloroisopropyl) ether
GC/MS	EPA 625	bis(2-Ethylhexyl) phthalate
GC/MS	EPA 625	4-Bromophenyl phenyl ether
GC/MS	EPA 625	n-Butylbenzenesulfonamide
GC/MS	EPA 625	Butyl benzyl phthalate
GC/MS	EPA 625	Caprolactam
GC/MS	EPA 625	Carbazole
GC/MS	EPA 625	4-Chloroaniline
GC/MS	EPA 625	Chlorobenzilate
GC/MS	EPA 625	p-Chlorobenzilate
GC/MS	EPA 625	4-Chloro-3-methylphenol
GC/MS	EPA 625	2-Chloronaphthalene
GC/MS	EPA 625	2-Chlorophenol
GC/MS	EPA 625	4-Chlorophenyl phenyl ether
GC/MS	EPA 625	Chrysene
GC/MS	EPA 625	Cresols (total)
GC/MS	EPA 625	Cyclohexanol

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 625	Diallate
GC/MS	EPA 625	Dibenzo(a,h)anthracene
GC/MS	EPA 625	Dibenzofuran
GC/MS	EPA 625	Di-n-butyl phthalate
GC/MS	EPA 625	1,2-Dichlorobenzene
GC/MS	EPA 625	1,3-Dichlorobenzene
GC/MS	EPA 625	1,4-Dichlorobenzene
GC/MS	EPA 625	3,3'-Dichlorobenzidine
GC/MS	EPA 625	2,4-Dichlorophenol
GC/MS	EPA 625	2,6-Dichlorophenol
GC/MS	EPA 625	Diethyl phthalate
GC/MS	EPA 625	O,O-Diethyl-O-(2-pyrazinyl) phosphorothioate
GC/MS	EPA 625	Dimethoate
GC/MS	EPA 625	p-Dimethylaminoazobenzene
GC/MS	EPA 625	7,12-Dimethylbenz(a)anthracene
GC/MS	EPA 625	3,3'-Dimethylbenzidine
GC/MS	EPA 625	Dimethylformamide
GC/MS	EPA 625	alpha,alpha-Dimethylphenethylamine
GC/MS	EPA 625	2,4-Dimethylphenol
GC/MS	EPA 625	Dimethyl phthalate
GC/MS	EPA 625	1,3-Dinitrobenzene
GC/MS	EPA 625	1,4-Dinitrobenzene
GC/MS	EPA 625	4,6-Dinitro-2-methylphenol
GC/MS	EPA 625	2,4-Dinitrophenol
GC/MS	EPA 625	2,4-Dinitrotoluene
GC/MS	EPA 625	2,6-Dinitrotoluene
GC/MS	EPA 625	2-sec-Butyl-4,6-dinitrophenol
GC/MS	EPA 625	Dinoseb
GC/MS	EPA 625	Di-n-octyl phthalate
GC/MS	EPA 625	1,4-Dioxane
GC/MS	EPA 625	1,2-Diphenylhydrazine (as Azobenzene)
GC/MS	EPA 625	Disulfoton
GC/MS	EPA 625	Ethyl methacrylate
GC/MS	EPA 625	Ethyl methanesulfonate

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 625	Famphur
GC/MS	EPA 625	Fluoranthene
GC/MS	EPA 625	Fluorene
GC/MS	EPA 625	Hexachlorobenzene
GC/MS	EPA 625	Hexachlorobutadiene
GC/MS	EPA 625	Hexachlorocyclopentadiene
GC/MS	EPA 625	Hexachloroethane
GC/MS	EPA 625	Hexachlorophene
GC/MS	EPA 625	Hexachloropropene
GC/MS	EPA 625	Indeno(1,2,3-cd)pyrene
GC/MS	EPA 625	Isodrin
GC/MS	EPA 625	Isophorone
GC/MS	EPA 625	Isosafrole
GC/MS	EPA 625	Kepone
GC/MS	EPA 625	Methapyrilene
GC/MS	EPA 625	2-Methylbenzenamine
GC/MS	EPA 625	3-Methylcholanthrene
GC/MS	EPA 625	4,4'-Methylenebis(2-chloroaniline)
GC/MS	EPA 625	Methyl methacrylate
GC/MS	EPA 625	Methyl methanesulfonate
GC/MS	EPA 625	2-Methylnaphthalene
GC/MS	EPA 625	Methyl parathion
GC/MS	EPA 625	2-Methylphenol
GC/MS	EPA 625	3-Methylphenol & 4-Methylphenol
GC/MS	EPA 625	2-Methylphenol, 3-methylphenol and 4-methylphenol
GC/MS	EPA 625	Methylphenols (total)
GC/MS	EPA 625	Naphthalene
GC/MS	EPA 625	1,4-Naphthoquinone
GC/MS	EPA 625	1-Naphthylamine
GC/MS	EPA 625	2-Naphthylamine
GC/MS	EPA 625	2-Nitroaniline
GC/MS	EPA 625	3-Nitroaniline
GC/MS	EPA 625	4-Nitroaniline

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 625	Nitrobenzene
GC/MS	EPA 625	2-Nitrophenol
GC/MS	EPA 625	4-Nitrophenol
GC/MS	EPA 625	4-Nitroquinoline-1-oxide
GC/MS	EPA 625	N-Nitrosodi-n-butylamine
GC/MS	EPA 625	N-Nitrosodiethylamine
GC/MS	EPA 625	N-Nitrosodimethylamine
GC/MS	EPA 625	N-Nitrosodiphenylamine
GC/MS	EPA 625	N-Nitrosodi-n-propylamine
GC/MS	EPA 625	N-Nitrosomethylethylamine
GC/MS	EPA 625	N-Nitrosomorpholine
GC/MS	EPA 625	N-Nitrosopiperidine
GC/MS	EPA 625	N-Nitrosopyrrolidine
GC/MS	EPA 625	5-Nitro-o-toluidine
GC/MS	EPA 625	2,2'-oxybis(1-Chloropropane)
GC/MS	EPA 625	Parathion
GC/MS	EPA 625	Pentachlorobenzene
GC/MS	EPA 625	Pentachloroethane
GC/MS	EPA 625	Pentachloronitrobenzene
GC/MS	EPA 625	Pentachlorophenol
GC/MS	EPA 625	Phenacetin
GC/MS	EPA 625	Phenanthrene
GC/MS	EPA 625	Phenol
GC/MS	EPA 625	p-Phenylene diamine
GC/MS	EPA 625	Phorate
GC/MS	EPA 625	2-Picoline
GC/MS	EPA 625	Pronamide
GC/MS	EPA 625	Pyrene
GC/MS	EPA 625	Pyridine
GC/MS	EPA 625	Safrole
GC/MS	EPA 625	Sulfotepp
GC/MS	EPA 625	1,2,4,5-Tetrachlorobenzene
GC/MS	EPA 625	2,3,4,6-Tetrachlorophenol
GC/MS	EPA 625	Tetraethyldithiopyrophosphate (Sulfotepp)

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 625	Thionazin
GC/MS	EPA 625	o-Toluidine
GC/MS	EPA 625	Tributyl phosphate
GC/MS	EPA 625	1,2,4-Trichlorobenzene
GC/MS	EPA 625	2,4,5-Trichlorophenol
GC/MS	EPA 625	2,4,6-Trichlorophenol
GC/MS	EPA 625	O,O,O-Triethyl phosphorothioate
GC/MS	EPA 625	1,3,5-Trinitrobenzene
GC/MS	EPA 625	Tris(2-chloroethyl)phosphate
GC/MS	EPA 625	1-Methyl naphthalene
GC-ECD	EPA 8081A/8081B	Aldrin
GC-ECD	EPA 8081A/8081B	alpha-BHC
GC-ECD	EPA 8081A/8081B	beta-BHC
GC-ECD	EPA 8081A/8081B	delta-BHC
GC-ECD	EPA 8081A/8081B	gamma-BHC (Lindane)
GC-ECD	EPA 8081A/8081B	alpha-Chlordane
GC-ECD	EPA 8081A/8081B	gamma-Chlordane
GC-ECD	EPA 8081A/8081B	Chlordane (technical)
GC-ECD	EPA 8081A/8081B	4,4'-DDD
GC-ECD	EPA 8081A/8081B	2,4'-DDD
GC-ECD	EPA 8081A/8081B	4,4'-DDE
GC-ECD	EPA 8081A/8081B	2,4'-DDE
GC-ECD	EPA 8081A/8081B	4,4'-DDT
GC-ECD	EPA 8081A/8081B	2,4'-DDT
GC-ECD	EPA 8081A/8081B	Dieldrin
GC-ECD	EPA 8081A/8081B	Endosulfan I
GC-ECD	EPA 8081A/8081B	Endosulfan II
GC-ECD	EPA 8081A/8081B	Endosulfan sulfate
GC-ECD	EPA 8081A/8081B	Endrin
GC-ECD	EPA 8081A/8081B	Endrin aldehyde
GC-ECD	EPA 8081A/8081B	Endrin ketone
GC-ECD	EPA 8081A/8081B	Heptachlor
GC-ECD	EPA 8081A/8081B	Heptachlor epoxide
GC-ECD	EPA 8081A/8081B	Methoxychlor

Non-Potable Water		
Technology	**Method**	**Analyte**
GC-ECD	EPA 8081A/8081B	Toxaphene
GC-ECD	EPA 608	Aldrin
GC-ECD	EPA 608	alpha-BHC
GC-ECD	EPA 608	beta-BHC
GC-ECD	EPA 608	delta-BHC
GC-ECD	EPA 608	gamma-BHC (Lindane)
GC-ECD	EPA 608	alpha-Chlordane
GC-ECD	EPA 608	gamma-Chlordane
GC-ECD	EPA 608	Chlordane (technical)
GC-ECD	EPA 608	4,4'-DDD
GC-ECD	EPA 608	2,4'-DDD
GC-ECD	EPA 608	4,4'-DDE
GC-ECD	EPA 608	2,4'-DDE
GC-ECD	EPA 608	4,4'-DDT
GC-ECD	EPA 608	2,4'-DDT
GC-ECD	EPA 608	Dieldrin
GC-ECD	EPA 608	Endosulfan I
GC-ECD	EPA 608	Endosulfan II
GC-ECD	EPA 608	Endosulfan sulfate
GC-ECD	EPA 608	Endrin
GC-ECD	EPA 608	Endrin aldehyde
GC-ECD	EPA 608	Endrin ketone
GC-ECD	EPA 608	Heptachlor
GC-ECD	EPA 608	Heptachlor epoxide
GC-ECD	EPA 608	Methoxychlor
GC-ECD	EPA 608	Toxaphene
GC-ECD	EPA 608	Aroclor 1016
GC-ECD	EPA 608	Aroclor 1221
GC-ECD	EPA 608	Aroclor 1232
GC-ECD	EPA 608	Aroclor 1242
GC-ECD	EPA 608	Aroclor 1248
GC-ECD	EPA 608	Aroclor 1254

ANSI-ASQ National Accreditation Board

Non-Potable Water		
Technology	**Method**	**Analyte**
GC-ECD	EPA 608	Aroclor 1260
GC-ECD	EPA 608	Aroclor 1262
GC-ECD	EPA 608	Aroclor 1268
GC-ECD	EPA 8082A/8082	Aroclor 1016
GC-ECD	EPA 8082A/8082	Aroclor 1221
GC-ECD	EPA 8082A/8082	Aroclor 1232
GC-ECD	EPA 8082A/8082	Aroclor 1242
GC-ECD	EPA 8082A/8082	Aroclor 1248
GC-ECD	EPA 8082A/8082	Aroclor 1254
GC-ECD	EPA 8082A/8082	Aroclor 1260
GC-ECD	EPA 8082A/8082	Aroclor 1262
GC-ECD	EPA 8082A/8082	Aroclor 1268
GC-FID	EPA 8015B	Ethanol
GC-FID	EPA 8015B	Methanol
GC-FID	EPA 8015B	Ethylene glycol
GC-FID	EPA 8015B	Propylene glycol
GC-FID	EPA 8015B	Diesel Range Organics
GC-FID	EPA 8015B	Motor Oil Range Organics
GC-FID	EPA 8015B	Gasoline Range Organics
HPLC	EPA 8330A/8330B	2-Amino-4,6-dinitrotoluene
HPLC	EPA 8330A/8330B	4-Amino-2,6-dinitrotoluene
HPLC	EPA 8330A/8330B	1,3-Dinitrobenzene
HPLC	EPA 8330A/8330B	2,4-Dinitrotoluene
HPLC	EPA 8330A/8330B	2,6-Dinitrotoluene
HPLC	EPA 8330A/8330B	HMX
HPLC	EPA 8330A/8330B	HNAB
HPLC	EPA 8330A/8330B	HNS
HPLC	EPA 8330A/8330B	Nitrobenzene
HPLC	EPA 8330A/8330B	Nitroglycerin
HPLC	EPA 8330A/8330B	2-Nitrotoluene
HPLC	EPA 8330A/8330B	3-Nitrotoluene
HPLC	EPA 8330A/8330B	4-Nitrotoluene

Non-Potable Water		
Technology	**Method**	**Analyte**
HPLC	EPA 8330A/8330B	PETN
HPLC	EPA 8330A/8330B	RDX
HPLC	EPA 8330A/8330B	TATB
HPLC	EPA 8330A/8330B	Tetryl
HPLC	EPA 8330A/8330B	MNX
HPLC	EPA 8330A/8330B	DNX
HPLC	EPA 8330A/8330B	TNX
HPLC	EPA 8330A/8330B	1,3,5-Trinitrobenzene
HPLC	EPA 8330A/8330B	2,4,6-Trinitrotoluene
GC/MS	EPA 8270C/8270D SIM	Acenaphthene
GC/MS	EPA 8270C/8270D SIM	Acenaphthylene
GC/MS	EPA 8270C/8270D SIM	Anthracene
GC/MS	EPA 8270C/8270D SIM	Benzo(a)anthracene
GC/MS	EPA 8270C/8270D SIM	Benzo(b)fluoranthene
GC/MS	EPA 8270C/8270D SIM	Benzo(k)fluoranthene
GC/MS	EPA 8270C/8270D SIM	Benzo(ghi)perylene
GC/MS	EPA 8270C/8270D SIM	Benzo(a)pyrene
GC/MS	EPA 8270C/8270D SIM	Chrysene
GC/MS	EPA 8270C/8270D SIM	Dibenz(a,h)anthracene
GC/MS	EPA 8270C/8270D SIM	Fluoranthene
GC/MS	EPA 8270C/8270D SIM	Fluorene
GC/MS	EPA 8270C/8270D SIM	Indeno(1,2,3-cd)pyrene
GC/MS	EPA 8270C/8270D SIM	Naphthalene
GC/MS	EPA 8270C/8270D SIM	Phenanthrene
GC/MS	EPA 8270C/8270D SIM	Pyrene
ICP-MS	EPA 6020/6020A/6020B	Aluminum
ICP-MS	EPA 6020/6020A/6020B	Antimony
ICP-MS	EPA 6020/6020A/6020B	Arsenic
ICP-MS	EPA 6020/6020A/6020B	Barium
ICP-MS	EPA 6020/6020A/6020B	Beryllium
ICP-MS	EPA 6020/6020A/6020B	Bismuth
ICP-MS	EPA 6020/6020A/6020B	Boron

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-MS	EPA 6020/6020A/6020B	Cadmium
ICP-MS	EPA 6020/6020A/6020B	Calcium
ICP-MS	EPA 6020/6020A/6020B	Cerium
ICP-MS	EPA 6020/6020A/6020B	Cesium
ICP-MS	EPA 6020/6020A/6020B	Chromium
ICP-MS	EPA 6020/6020A/6020B	Cobalt
ICP-MS	EPA 6020/6020A/6020B	Copper
ICP-MS	EPA 6020/6020A/6020B	Gold
ICP-MS	EPA 6020/6020A/6020B	Hafnium
ICP-MS	EPA 6020/6020A/6020B	Iron
ICP-MS	EPA 6020/6020A/6020B	Lanthanum
ICP-MS	EPA 6020/6020A/6020B	Lead
ICP-MS	EPA 6020/6020A/6020B	Lithium
ICP-MS	EPA 6020/6020A/6020B	Magnesium
ICP-MS	EPA 6020/6020A/6020B	Manganese
ICP-MS	EPA 6020/6020A/6020B	Molybdenum
ICP-MS	EPA 6020/6020A/6020B	Neodymium
ICP-MS	EPA 6020/6020A/6020B	Nickel
ICP-MS	EPA 6020/6020A/6020B	Niobium
ICP-MS	EPA 6020/6020A/6020B	Palladium
ICP-MS	EPA 6020/6020A/6020B	Phosphorus
ICP-MS	EPA 6020/6020A/6020B	Platinum
ICP-MS	EPA 6020/6020A/6020B	Potassium
ICP-MS	EPA 6020/6020A/6020B	Praseodymium
ICP-MS	EPA 6020/6020A/6020B	Rhenium
ICP-MS	EPA 6020/6020A/6020B	Rhodium
ICP-MS	EPA 6020/6020A/6020B	Ruthenium
ICP-MS	EPA 6020/6020A/6020B	Samarium
ICP-MS	EPA 6020/6020A/6020B	Selenium
ICP-MS	EPA 6020/6020A/6020B	Silicon
ICP-MS	EPA 6020/6020A/6020B	Silver
ICP-MS	EPA 6020/6020A/6020B	Sodium

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-MS	EPA 6020/6020A/6020B	Strontium
ICP-MS	EPA 6020/6020A/6020B	Tantalum
ICP-MS	EPA 6020/6020A/6020B	Tellurium
ICP-MS	EPA 6020/6020A/6020B	Thallium
ICP-MS	EPA 6020/6020A/6020B	Thorium
ICP-MS	EPA 6020/6020A/6020B	Tin
ICP-MS	EPA 6020/6020A/6020B	Titanium
ICP-MS	EPA 6020/6020A/6020B	Tungsten
ICP-MS	EPA 6020/6020A/6020B	Uranium
ICP-MS	EPA 6020/6020A/6020B	Uranium 233
ICP-MS	EPA 6020/6020A/6020B	Uranium 234
ICP-MS	EPA 6020/6020A/6020B	Uranium 235
ICP-MS	EPA 6020/6020A/6020B	Uranium 236
ICP-MS	EPA 6020/6020A/6020B	Uranium 238
ICP-MS	EPA 6020/6020A/6020B	Vanadium
ICP-MS	EPA 6020/6020A/6020B	Yttrium
ICP-MS	EPA 6020/6020A/6020B	Zinc
ICP-MS	EPA 6020/6020A/6020B	Zirconium
ICP-MS	EPA 200.8	Aluminum
ICP-MS	EPA 200.8	Antimony
ICP-MS	EPA 200.8	Arsenic
ICP-MS	EPA 200.8	Barium
ICP-MS	EPA 200.8	Beryllium
ICP-MS	EPA 200.8	Bismuth
ICP-MS	EPA 200.8	Boron
ICP-MS	EPA 200.8	Cadmium
ICP-MS	EPA 200.8	Calcium
ICP-MS	EPA 200.8	Cerium
ICP-MS	EPA 200.8	Cesium
ICP-MS	EPA 200.8	Chromium
ICP-MS	EPA 200.8	Cobalt
ICP-MS	EPA 200.8	Copper

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-MS	EPA 200.8	Gold
ICP-MS	EPA 200.8	Hafnium
ICP-MS	EPA 200.8	Iron
ICP-MS	EPA 200.8	Lanthanum
ICP-MS	EPA 200.8	Lead
ICP-MS	EPA 200.8	Lithium
ICP-MS	EPA 200.8	Magnesium
ICP-MS	EPA 200.8	Manganese
ICP-MS	EPA 200.8	Molybdenum
ICP-MS	EPA 200.8	Neodymium
ICP-MS	EPA 200.8	Nickel
ICP-MS	EPA 200.8	Niobium
ICP-MS	EPA 200.8	Palladium
ICP-MS	EPA 200.8	Phosphorus
ICP-MS	EPA 200.8	Platinum
ICP-MS	EPA 200.8	Potassium
ICP-MS	EPA 200.8	Praseodymium
ICP-MS	EPA 200.8	Rhenium
ICP-MS	EPA 200.8	Rhodium
ICP-MS	EPA 200.8	Ruthenium
ICP-MS	EPA 200.8	Samarium
ICP-MS	EPA 200.8	Selenium
ICP-MS	EPA 200.8	Silicon
ICP-MS	EPA 200.8	Silver
ICP-MS	EPA 200.8	Sodium
ICP-MS	EPA 200.8	Strontium
ICP-MS	EPA 200.8	Tantalum
ICP-MS	EPA 200.8	Tellurium
ICP-MS	EPA 200.8	Thallium
ICP-MS	EPA 200.8	Thorium
ICP-MS	EPA 200.8	Tin
ICP-MS	EPA 200.8	Titanium

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-MS	EPA 200.8	Tungsten
ICP-MS	EPA 200.8	Uranium
ICP-MS	EPA 200.8	Vanadium
ICP-MS	EPA 200.8	Yttrium
ICP-MS	EPA 200.8	Zinc
ICP-MS	EPA 200.8	Zirconium
ICP-AES	EPA 200.7	Aluminum
ICP-AES	EPA 200.7	Antimony
ICP-AES	EPA 200.7	Arsenic
ICP-AES	EPA 200.7	Barium
ICP-AES	EPA 200.7	Beryllium
ICP-AES	EPA 200.7	Bismuth
ICP-AES	EPA 200.7	Boron
ICP-AES	EPA 200.7	Cadmium
ICP-AES	EPA 200.7	Calcium
ICP-AES	EPA 200.7	Chromium
ICP-AES	EPA 200.7	Cobalt
ICP-AES	EPA 200.7	Copper
ICP-AES	EPA 200.7	Iron
ICP-AES	EPA 200.7	Lead
ICP-AES	EPA 200.7	Lithium
ICP-AES	EPA 200.7	Magnesium
ICP-AES	EPA 200.7	Manganese
ICP-AES	EPA 200.7	Molybdenum
ICP-AES	EPA 200.7	Nickel
ICP-AES	EPA 200.7	Phosphorus
ICP-AES	EPA 200.7	Potassium
ICP-AES	EPA 200.7	Selenium
ICP-AES	EPA 200.7	Silicon
ICP-AES	EPA 200.7	Silver
ICP-AES	EPA 200.7	Sodium
ICP-AES	EPA 200.7	Strontium

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Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-AES	EPA 200.7	Sulfur
ICP-AES	EPA 200.7	Thallium
ICP-AES	EPA 200.7	Thorium
ICP-AES	EPA 200.7	Tin
ICP-AES	EPA 200.7	Titanium
ICP-AES	EPA 200.7	Vanadium
ICP-AES	EPA 200.7	Zinc
CVAA	EPA 7470A	Mercury
Colorimetric	EPA 9010C EPA 9012A/9012B	Cyanide
Ion Chromatrography	EPA 300.0/9056/9056A	Bromide
Ion Chromatrography	EPA 300.0/9056/9056A	Chloride
Ion Chromatrography	EPA 300.0/9056/9056A	Fluoride
Ion Chromatrography	EPA 300.0/9056/9056A	Nitrate
Ion Chromatrography	EPA 300.0/9056/9056A	Nitrite
Ion Chromatrography	EPA 300.0/9056/9056A	Sulfate
Ion Chromatrography	EPA 300.0/9056/9056A	Ortho-phosphate
Ion Chromatrography	EPA 300.0/9056/9056A	Iodide
Ion Chromatrography	EPA 314.0	Perchlorate
Gravimetric	SM 2540B SM 2540C SM 2540D	Solids
Probe	EPA 9040B/C EPA 150.1	pH
Titration	SM 2320B EPA 310.1	Alkalinity
Titration	EPA 9030B EPA 9034/9034A	Sulfide
Penske-Martin	EPA 1010/1010A	Ignitability
Colormetric	EPA 353.1	nitrate/Nitrite
Colormetric	EPA 350.1	Ammonia
Colorimetric	EPA 410.4	COD
Colorimetric	EPA 365.2	Total Phosphorus

Non-Potable Water		
Technology	**Method**	**Analyte**
TOC Analyzer	EPA 9060A	TOC
Tritrmetric	EPA 9020B	TOX
Colormetric	EPA 7196A	Hex Chromium
Gravimetric	EPA 1664A	Oil & Grease
Gravimetric	EPA 1664A	TPH
Probe	EPA 9050A	Conductivity
Gas Flow Proportional Counter	EPA 900.0 EPA 9310 SM 7110C	gross alpha/beta
Gas Flow Proportional Counter	ST-RC-0036 ST-RD-0403	Chlorine-36
Gas Flow Proportional Counter	EPA 903.0 EPA 9315	Radium-226
Gas Flow Proportional Counter	EPA 903.0 EPA 9315	total radium
Gas Flow Proportional Counter	EPA 904.0 EPA 9320	Radium-228
Gas Flow Proportional Counter	EPA 905.0 DOE HASL 300 Sr-02 DOE HASL 300 Sr-03	Strontium-90
Liquid Scintillation Counter	EPA 906.0	Tritium
Liquid Scintillation Counter	Eichrom Technologies TCW01/TCS01	Tecnetium-99
Liquid Scintillation Counter	EERF C-01-C14	Carbon-14
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Gamma Emitters:
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Actinium 227 (assumes equilibrium w/ Th-227)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Actinium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Americium 241
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Antimony 124
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Antimony 125

Non-Potable Water		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium-137
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium/Lanthanum-140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium 133
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium 140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Beryllium 7
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 211 eq Th-227
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 207
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth-210M
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 212
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 214
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Calcium-45
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 141
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 139
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 144
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cesium 134
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cesium 137
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 56
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 57
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 58
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 60

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Non-Potable Water		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 152
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 154
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 155
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Hafnium 181
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iodine 131
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iridium 192
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iron 59
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lanthanum 140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 210
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 211
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 212
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 214
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Manganese-56
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Manganese 54
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Mercury 203
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Neptunium 237
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Neptunium 239
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Niobium 83
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Niobium 94
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Niobium 95

Non-Potable Water		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Potassium 40
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 144
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 146
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 147
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 234M
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 231
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 234
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium (226)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 223 (assumes equilibrium w/ Th-227)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 224
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Ruthenium 106
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Scandium 46
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Sodium 22
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Sodium 24
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Strontium 85
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thallium 208
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 227
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 230

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Non-Potable Water		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 231
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 232
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 234
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Tin 113
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Uranium 235
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Uranium 238
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Vanadium-48
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Yttrium 88
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Zinc 65
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Zirconium 95
Alpha Spectroscopy	DOE HASL 300 A-01-R	Alpha spec analysis:
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Uranium
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Thorium
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Americium
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Plutonium
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Neptunium
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Curium
Liquid Scintillation Counter	Eichrom Technologies OTW01, OTS01	Lead-210
Alpha Spectroscopy	Laboratory SOP ST-RC-0210	Polonium-210
Liquid Scintillation Counter	Eichrom Technologies FEW01	Iron-55

Non-Potable Water		
Technology	**Method**	**Analyte**
Liquid Scintillation Counter	DOE RP-300	Nickel 59/63
Liquid Scintillation Counter	SM 7500-IB	Iodine-129
Preparation	**Method**	**Type**
Organic Extraction & Sample Prep	EPA 3500C	Organic Extraction & Sample Prep
Volatile Prep	EPA 5000	Sample Preparation for Volatile Organic Compounds
Organic prep/analysis	EPA 8000C	Determinative Chromatographic Separations
Acid Digestion (Aqueous samples)	EPA 3010A	Acid Digestion for Metals (Aqueous samples)
Purge & Trap	EPA 5030C	Purge & Trap for Aqueous Volatile
Sep Funnel Liquid-Liquid Extraction	EPA 3510C	Sep Funnel Liquid-Liquid Extraction
Organic Cleanup	EPA 3600A	Cleanup for Organic extracts
Florisil Cleanup	EPA 3620C	Florisil Cleanup
Sulfur Cleanup	EPA 3660B	Sulfur Cleanup
Acid Clean Up	EPA 3665A	Acid Clean Up for PCBs
TCLP Extraction	EPA 1311	TCLP Extraction
SPLP Extraction	EPA 1312	SPLP Extraction
CWET Extraction	CA Title 22	CWET Extraction
Solid Phase Extraction	EPA 3535A	Solid Phase Extraction

Drinking Water		
Technology	**Method**	**Analyte**
Gas Flow Proportional Counter	EPA 900.0 EPA 9310	gross alpha/beta
Gas Flow Proportional Counter	ST-RC-0036 ST-RD-0403	Chlorine-36
Gas Flow Proportional Counter	EPA 903.0 EPA 9315	Radium-226
Gas Flow Proportional Counter	EPA 904.0 EPA 9320	Radium-228
Gas Flow Proportional Counter	EPA 905.0 DOE HASL 300 Sr-02	Strontium-90
Liquid Scintillation Counter	EPA 906.0	Tritium
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Gamma Emitters:
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Actinium 227 (assumes equilibrium w/ Th-227)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Actinium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Americium 241
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Antimony 124
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Antimony 125
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium-137
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium/Lanthanum-140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium 133
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium 140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Beryllium 7
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 211 eq Th-227

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Drinking Water		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 207
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth-210M
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 212
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 214
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Calcium-45
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 141
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 139
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 144
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cesium 134
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cesium 137
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 56
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 57
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 58
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 60
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 152
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 154
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 155
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Hafnium 181

Drinking Water		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iodine 131
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iridium 192
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iron 59
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lanthanum 140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 210
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 211
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 212
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 214
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Manganese-56
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Manganese 54
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Mercury 203
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Neptunium 237
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Neptunium 239
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Niobium 83
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Niobium 94
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Niobium 95
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Potassium 40
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 144

Drinking Water		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 146
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 147
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 234M
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 231
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 234
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium (226)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 223 (assumes equilibrium w/ Th-227)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 224
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Ruthenium 106
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Scandium 46
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Sodium 22
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Sodium 24
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Strontium 85
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thallium 208
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 227
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 230

Drinking Water		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 231
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 232
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 234
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Tin 113
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Uranium 235
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Uranium 238
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Vanadium-48
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Yttrium 88
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Zinc 65
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Zirconium 95

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
ICP-AES	EPA 6010B/6010C/6010D	Aluminum
ICP-AES	EPA 6010B/6010C/6010D	Antimony
ICP-AES	EPA 6010B/6010C/6010D	Arsenic
ICP-AES	EPA 6010B/6010C/6010D	Barium
ICP-AES	EPA 6010B/6010C/6010D	Beryllium
ICP-AES	EPA 6010B/6010C/6010D	Bismuth
ICP-AES	EPA 6010B/6010C/6010D	Boron
ICP-AES	EPA 6010B/6010C/6010D	Cadmium
ICP-AES	EPA 6010B/6010C/6010D	Calcium

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
ICP-AES	EPA 6010B/6010C/6010D	Chromium
ICP-AES	EPA 6010B/6010C/6010D	Cobalt
ICP-AES	EPA 6010B/6010C/6010D	Copper
ICP-AES	EPA 6010B/6010C/6010D	Iron
ICP-AES	EPA 6010B/6010C/6010D	Lead
ICP-AES	EPA 6010B/6010C/6010D	Lithium
ICP-AES	EPA 6010B/6010C/6010D	Magnesium
ICP-AES	EPA 6010B/6010C/6010D	Manganese
ICP-AES	EPA 6010B/6010C/6010D	Molybdenum
ICP-AES	EPA 6010B/6010C/6010D	Nickel
ICP-AES	EPA 6010B/6010C/6010D	Phosphorus
ICP-AES	EPA 6010B/6010C/6010D	Potassium
ICP-AES	EPA 6010B/6010C/6010D	Selenium
ICP-AES	EPA 6010B/6010C/6010D	Silicon
ICP-AES	EPA 6010B/6010C/6010D	Silver
ICP-AES	EPA 6010B/6010C/6010D	Sodium
ICP-AES	EPA 6010B/6010C/6010D	Strontium
ICP-AES	EPA 6010B/6010C/6010D	Sulfur
ICP-AES	EPA 6010B/6010C/6010D	Thallium
ICP-AES	EPA 6010B/6010C/6010D	Thorium
ICP-AES	EPA 6010B/6010C/6010D	Tin
ICP-AES	EPA 6010B/6010C/6010D	Titanium
ICP-AES	EPA 6010B/6010C/6010D	Vanadium
ICP-AES	EPA 6010B/6010C/6010D	Zinc
GC/MS	EPA 8260B/8260C	Acetone
GC/MS	EPA 8260B/8260C	Acetonitrile
GC/MS	EPA 8260B/8260C	Acrolein
GC/MS	EPA 8260B/8260C	Acrylonitrile
GC/MS	EPA 8260B/8260C	Benzene
GC/MS	EPA 8260B/8260C	Benzyl chloride
GC/MS	EPA 8260B/8260C	Bromobenzene
GC/MS	EPA 8260B/8260C	Bromochloromethane

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/8260C	Bromodichloromethane
GC/MS	EPA 8260B/8260C	Bromoform
GC/MS	EPA 8260B/8260C	Bromomethane
GC/MS	EPA 8260B/8260C	n-Butanol
GC/MS	EPA 8260B/8260C	2-Butanone
GC/MS	EPA 8260B/8260C	n-Butylbenzene
GC/MS	EPA 8260B/8260C	sec-Butylbenzene
GC/MS	EPA 8260B/8260C	tert-Butylbenzene
GC/MS	EPA 8260B/8260C	Carbon disulfide
GC/MS	EPA 8260B/8260C	Carbon tetrachloride
GC/MS	EPA 8260B/8260C	Chlorobenzene
GC/MS	EPA 8260B/8260C	2-Chloro-1,3-butadiene
GC/MS	EPA 8260B/8260C	Chlorodibromomethane
GC/MS	EPA 8260B/8260C	Chloroethane
GC/MS	EPA 8260B/8260C	2-Chloroethyl vinyl ether
GC/MS	EPA 8260B/8260C	Chloroform
GC/MS	EPA 8260B/8260C	Chloromethane
GC/MS	EPA 8260B/8260C	Allyl chloride
GC/MS	EPA 8260B/8260C	2-Chlorotoluene
GC/MS	EPA 8260B/8260C	4-Chlorotoluene
GC/MS	EPA 8260B/8260C	Cyclohexane
GC/MS	EPA 8260B/8260C	Cyclohexanone
GC/MS	EPA 8260B/8260C	1,2-Dibromo-3-chloropropane
GC/MS	EPA 8260B/8260C	1,2-Dibromoethane
GC/MS	EPA 8260B/8260C	Dibromomethane
GC/MS	EPA 8260B/8260C	1,2-Dichlorobenzene
GC/MS	EPA 8260B/8260C	1,3-Dichlorobenzene
GC/MS	EPA 8260B/8260C	1,4-Dichlorobenzene
GC/MS	EPA 8260B/8260C	trans-1,4-Dichloro-2-butene
GC/MS	EPA 8260B/8260C	Dichlorodifluoromethane
GC/MS	EPA 8260B/8260C	1,1-Dichloroethane
GC/MS	EPA 8260B/8260C	1,2-Dichloroethane

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Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/8260C	cis-1,2-Dichloroethene
GC/MS	EPA 8260B/8260C	trans-1,2-Dichloroethene
GC/MS	EPA 8260B/8260C	1,1-Dichloroethene
GC/MS	EPA 8260B/8260C	1,2-Dichloroethene (total)
GC/MS	EPA 8260B/8260C	1,2-Dichloropropane
GC/MS	EPA 8260B/8260C	1,3-Dichloropropane
GC/MS	EPA 8260B/8260C	2,2-Dichloropropane
GC/MS	EPA 8260B/8260C	cis-1,3-Dichloropropene
GC/MS	EPA 8260B/8260C	trans-1,3-Dichloropropene
GC/MS	EPA 8260B/8260C	1,1-Dichloropropene
GC/MS	EPA 8260B/8260C	1,2-Dichloro-1,1,2,2-tetrafluoroethane
GC/MS	EPA 8260B/8260C	Dimethyl disulfide
GC/MS	EPA 8260B/8260C	1,4-Dioxane
GC/MS	EPA 8260B/8260C	Ethyl acetate
GC/MS	EPA 8260B/8260C	Ethylbenzene
GC/MS	EPA 8260B/8260C	Ethyl ether
GC/MS	EPA 8260B/8260C	Diethyl ether
GC/MS	EPA 8260B/8260C	Ethyl methacrylate
GC/MS	EPA 8260B/8260C	Freon 113
GC/MS	EPA 8260B/8260C	Hexachlorobutadiene
GC/MS	EPA 8260B/8260C	n-Hexane
GC/MS	EPA 8260B/8260C	2-Hexanone
GC/MS	EPA 8260B/8260C	Iodomethane
GC/MS	EPA 8260B/8260C	Isobutanol
GC/MS	EPA 8260B/8260C	Isopropylbenzene
GC/MS	EPA 8260B/8260C	p-Isopropyltoluene
GC/MS	EPA 8260B/8260C	Methacrylonitrile
GC/MS	EPA 8260B/8260C	Methyl acetate
GC/MS	EPA 8260B/8260C	Methylcyclohexane
GC/MS	EPA 8260B/8260C	Methylene chloride
GC/MS	EPA 8260B/8260C	Methyl methacrylate
GC/MS	EPA 8260B/8260C	4-Methyl-2-pentanone

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/8260C	MTBE
GC/MS	EPA 8260B/8260C	Naphthalene
GC/MS	EPA 8260B/8260C	2-Nitropropane
GC/MS	EPA 8260B/8260C	Nonanal
GC/MS	EPA 8260B/8260C	Pentachloroethane
GC/MS	EPA 8260B/8260C	Propionitrile
GC/MS	EPA 8260B/8260C	n-Propylbenzene
GC/MS	EPA 8260B/8260C	Styrene
GC/MS	EPA 8260B/8260C	1,1,1,2-Tetrachloroethane
GC/MS	EPA 8260B/8260C	1,1,2,2-Tetrachloroethane
GC/MS	EPA 8260B/8260C	Tetrachloroethene
GC/MS	EPA 8260B/8260C	Tetrahydrofuran
GC/MS	EPA 8260B/8260C	Toluene
GC/MS	EPA 8260B/8260C	1,3,5-Trichlorobenzene
GC/MS	EPA 8260B/8260C	1,2,3-Trichlorobenzene
GC/MS	EPA 8260B/8260C	1,2,4-Trichlorobenzene
GC/MS	EPA 8260B/8260C	1,1,1-Trichloroethane
GC/MS	EPA 8260B/8260C	1,1,2-Trichloroethane
GC/MS	EPA 8260B/8260C	Trichloroethene
GC/MS	EPA 8260B/8260C	Trichlorofluoromethane
GC/MS	EPA 8260B/8260C	1,2,3-Trichloropropane
GC/MS	EPA 8260B/8260C	1,1,2-Trichloro-1,2,2-trifluoroethane
GC/MS	EPA 8260B/8260C	Trichlorotrifluoroethane
GC/MS	EPA 8260B/8260C	1,2,4-Trimethylbenzene
GC/MS	EPA 8260B/8260C	1,3,5-Trimethylbenzene
GC/MS	EPA 8260B/8260C	Vinyl acetate
GC/MS	EPA 8260B/8260C	Vinyl chloride
GC/MS	EPA 8260B/8260C	m-Xylene & p-Xylene
GC/MS	EPA 8260B/8260C	o-Xylene
GC/MS	EPA 8260B/8260C	Xylenes (total)
GC/MS	EPA 8270C/8270D	Acenaphthene
GC/MS	EPA 8270C/8270D	Acenaphthylene

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/8270D	Acetophenone
GC/MS	EPA 8270C/8270D	2-Acetylaminofluorene
GC/MS	EPA 8270C/8270D	4-Aminobiphenyl
GC/MS	EPA 8270C/8270D	Aniline
GC/MS	EPA 8270C/8270D	Anthracene
GC/MS	EPA 8270C/8270D	Aramite (total)
GC/MS	EPA 8270C/8270D	Atrazine
GC/MS	EPA 8270C/8270D	Azobenzene
GC/MS	EPA 8270C/8270D	Benzaldehyde
GC/MS	EPA 8270C/8270D	Benzidine
GC/MS	EPA 8270C/8270D	Benzo(a)anthracene
GC/MS	EPA 8270C/8270D	Benzo(b)fluoranthene
GC/MS	EPA 8270C/8270D	Benzo(k)fluoranthene
GC/MS	EPA 8270C/8270D	Benzoic acid
GC/MS	EPA 8270C/8270D	Benzo(ghi)perylene
GC/MS	EPA 8270C/8270D	Benzo(a)pyrene
GC/MS	EPA 8270C/8270D	Benzyl alcohol
GC/MS	EPA 8270C/8270D	1,1'-Biphenyl
GC/MS	EPA 8270C/8270D	bis(2-Chloroethoxy)methane
GC/MS	EPA 8270C/8270D	bis(2-Chloroethyl) ether
GC/MS	EPA 8270C/8270D	bis(2-Chloroisopropyl) ether
GC/MS	EPA 8270C/8270D	bis(2-Ethylhexyl) phthalate
GC/MS	EPA 8270C/8270D	4-Bromophenyl phenyl ether
GC/MS	EPA 8270C/8270D	n-Butylbenzenesulfonamide
GC/MS	EPA 8270C/8270D	Butyl benzyl phthalate
GC/MS	EPA 8270C/8270D	Caprolactam
GC/MS	EPA 8270C/8270D	Carbazole
GC/MS	EPA 8270C/8270D	4-Chloroaniline
GC/MS	EPA 8270C/8270D	Chlorobenzilate
GC/MS	EPA 8270C/8270D	p-Chlorobenzilate
GC/MS	EPA 8270C/8270D	4-Chloro-3-methylphenol
GC/MS	EPA 8270C/8270D	2-Chloronaphthalene

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Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/8270D	2-Chlorophenol
GC/MS	EPA 8270C/8270D	4-Chlorophenyl phenyl ether
GC/MS	EPA 8270C/8270D	Chrysene
GC/MS	EPA 8270C/8270D	Cresols (total)
GC/MS	EPA 8270C/8270D	Cyclohexanol
GC/MS	EPA 8270C/8270D	Diallate
GC/MS	EPA 8270C/8270D	Dibenz(a,h)anthracene
GC/MS	EPA 8270C/8270D	Dibenzo(a,h)anthracene
GC/MS	EPA 8270C/8270D	Dibenzofuran
GC/MS	EPA 8270C/8270D	Di-n-butyl phthalate
GC/MS	EPA 8270C/8270D	1,2-Dichlorobenzene
GC/MS	EPA 8270C/8270D	1,3-Dichlorobenzene
GC/MS	EPA 8270C/8270D	1,4-Dichlorobenzene
GC/MS	EPA 8270C/8270D	3,3'-Dichlorobenzidine
GC/MS	EPA 8270C/8270D	2,4-Dichlorophenol
GC/MS	EPA 8270C/8270D	2,6-Dichlorophenol
GC/MS	EPA 8270C/8270D	Diethyl phthalate
GC/MS	EPA 8270C/8270D	O,O-Diethyl-O-(2-pyrazinyl) phosphorothioate
GC/MS	EPA 8270C/8270D	Dimethoate
GC/MS	EPA 8270C/8270D	p-Dimethylaminoazobenzene
GC/MS	EPA 8270C/8270D	7,12-Dimethylbenz(a)anthracene
GC/MS	EPA 8270C/8270D	3,3'-Dimethylbenzidine
GC/MS	EPA 8270C/8270D	Dimethylformamide
GC/MS	EPA 8270C/8270D	alpha,alpha-Dimethylphenethylamine
GC/MS	EPA 8270C/8270D	2,4-Dimethylphenol
GC/MS	EPA 8270C/8270D	Dimethyl phthalate
GC/MS	EPA 8270C/8270D	1,3-Dinitrobenzene
GC/MS	EPA 8270C/8270D	1,4-Dinitrobenzene
GC/MS	EPA 8270C/8270D	4,6-Dinitro-2-methylphenol
GC/MS	EPA 8270C/8270D	2,4-Dinitrophenol
GC/MS	EPA 8270C/8270D	2,4-Dinitrotoluene
GC/MS	EPA 8270C/8270D	2,6-Dinitrotoluene

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Solid and Chemical Materials

Technology	Method	Analyte
GC/MS	EPA 8270C/8270D	2-sec-Butyl-4,6-dinitrophenol
GC/MS	EPA 8270C/8270D	Dinoseb
GC/MS	EPA 8270C/8270D	Di-n-octyl phthalate
GC/MS	EPA 8270C/8270D	1,4-Dioxane
GC/MS	EPA 8270C/8270D	1,2-Diphenylhydrazine (as Azobenzene)
GC/MS	EPA 8270C/8270D	Disulfoton
GC/MS	EPA 8270C/8270D	Ethyl methacrylate
GC/MS	EPA 8270C/8270D	Ethyl methanesulfonate
GC/MS	EPA 8270C/8270D	Famphur
GC/MS	EPA 8270C/8270D	Fluoranthene
GC/MS	EPA 8270C/8270D	Fluorene
GC/MS	EPA 8270C/8270D	Hexachlorobenzene
GC/MS	EPA 8270C/8270D	Hexachlorobutadiene
GC/MS	EPA 8270C/8270D	Hexachlorocyclopentadiene
GC/MS	EPA 8270C/8270D	Hexachloroethane
GC/MS	EPA 8270C/8270D	Hexachlorophene
GC/MS	EPA 8270C/8270D	Hexachloropropene
GC/MS	EPA 8270C/8270D	Indeno(1,2,3-cd)pyrene
GC/MS	EPA 8270C/8270D	Isodrin
GC/MS	EPA 8270C/8270D	Isophorone
GC/MS	EPA 8270C/8270D	Isosafrole
GC/MS	EPA 8270C/8270D	Kepone
GC/MS	EPA 8270C/8270D	Methapyrilene
GC/MS	EPA 8270C/8270D	2-Methylbenzenamine
GC/MS	EPA 8270C/8270D	3-Methylcholanthrene
GC/MS	EPA 8270C/8270D	4,4'-Methylenebis(2-chloroaniline)
GC/MS	EPA 8270C/8270D	Methyl methacrylate
GC/MS	EPA 8270C/8270D	Methyl methanesulfonate
GC/MS	EPA 8270C/8270D	2-Methylnaphthalene
GC/MS	EPA 8270C/8270D	Methyl parathion
GC/MS	EPA 8270C/8270D	2-Methylphenol
GC/MS	EPA 8270C/8270D	3-Methylphenol & 4-Methylphenol

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/8270D	2-Methylphenol, 3-methylphenol and 4-methylphenol
GC/MS	EPA 8270C/8270D	Methylphenols (total)
GC/MS	EPA 8270C/8270D	Naphthalene
GC/MS	EPA 8270C/8270D	1,4-Naphthoquinone
GC/MS	EPA 8270C/8270D	1-Naphthylamine
GC/MS	EPA 8270C/8270D	2-Naphthylamine
GC/MS	EPA 8270C/8270D	2-Nitroaniline
GC/MS	EPA 8270C/8270D	3-Nitroaniline
GC/MS	EPA 8270C/8270D	4-Nitroaniline
GC/MS	EPA 8270C/8270D	Nitrobenzene
GC/MS	EPA 8270C/8270D	2-Nitrophenol
GC/MS	EPA 8270C/8270D	4-Nitrophenol
GC/MS	EPA 8270C/8270D	4-Nitroquinoline-1-oxide
GC/MS	EPA 8270C/8270D	N-Nitrosodi-n-butylamine
GC/MS	EPA 8270C/8270D	N-Nitrosodiethylamine
GC/MS	EPA 8270C/8270D	N-Nitrosodimethylamine
GC/MS	EPA 8270C/8270D	N-Nitrosodiphenylamine
GC/MS	EPA 8270C/8270D	N-Nitrosodi-n-propylamine
GC/MS	EPA 8270C/8270D	N-Nitrosomethylethylamine
GC/MS	EPA 8270C/8270D	N-Nitrosomorpholine
GC/MS	EPA 8270C/8270D	N-Nitrosopiperidine
GC/MS	EPA 8270C/8270D	N-Nitrosopyrrolidine
GC/MS	EPA 8270C/8270D	5-Nitro-o-toluidine
GC/MS	EPA 8270C/8270D	2,2'-oxybis(1-Chloropropane)
GC/MS	EPA 8270C/8270D	Parathion
GC/MS	EPA 8270C/8270D	Pentachlorobenzene
GC/MS	EPA 8270C/8270D	Pentachloroethane
GC/MS	EPA 8270C/8270D	Pentachloronitrobenzene
GC/MS	EPA 8270C/8270D	Pentachlorophenol
GC/MS	EPA 8270C/8270D	Phenacetin
GC/MS	EPA 8270C/8270D	Phenanthrene
GC/MS	EPA 8270C/8270D	Phenol

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/8270D	p-Phenylene diamine
GC/MS	EPA 8270C/8270D	Phorate
GC/MS	EPA 8270C/8270D	2-Picoline
GC/MS	EPA 8270C/8270D	Pronamide
GC/MS	EPA 8270C/8270D	Pyrene
GC/MS	EPA 8270C/8270D	Pyridine
GC/MS	EPA 8270C/8270D	Safrole
GC/MS	EPA 8270C/8270D	Sulfotepp
GC/MS	EPA 8270C/8270D	1,2,4,5-Tetrachlorobenzene
GC/MS	EPA 8270C/8270D	2,3,4,6-Tetrachlorophenol
GC/MS	EPA 8270C/8270D	Tetraethyldithiopyrophosphate (Sulfotepp)
GC/MS	EPA 8270C/8270D	Thionazin
GC/MS	EPA 8270C/8270D	o-Toluidine
GC/MS	EPA 8270C/8270D	Tributyl phosphate
GC/MS	EPA 8270C/8270D	1,2,4-Trichlorobenzene
GC/MS	EPA 8270C/8270D	2,4,5-Trichlorophenol
GC/MS	EPA 8270C/8270D	2,4,6-Trichlorophenol
GC/MS	EPA 8270C/8270D	O,O,O-Triethyl phosphorothioate
GC/MS	EPA 8270C/8270D	1,3,5-Trinitrobenzene
GC/MS	EPA 8270C/8270D	Tris(2-chloroethyl)phosphate
GC/MS	EPA 8270C/8270D	1-Methyl naphthalene
GC-ECD	EPA 8081A/8081B	Aldrin
GC-ECD	EPA 8081A/8081B	alpha-BHC
GC-ECD	EPA 8081A/8081B	beta-BHC
GC-ECD	EPA 8081A/8081B	delta-BHC
GC-ECD	EPA 8081A/8081B	gamma-BHC (Lindane)
GC-ECD	EPA 8081A/8081B	alpha-Chlordane
GC-ECD	EPA 8081A/8081B	gamma-Chlordane
GC-ECD	EPA 8081A/8081B	Chlordane (technical)
GC-ECD	EPA 8081A/8081B	4,4'-DDD
GC-ECD	EPA 8081A/8081B	2,4'-DDD
GC-ECD	EPA 8081A/8081B	4,4'-DDE

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC-ECD	EPA 8081A/8081B	2,4'-DDE
GC-ECD	EPA 8081A/8081B	4,4'-DDT
GC-ECD	EPA 8081A/8081B	2,4'-DDT
GC-ECD	EPA 8081A/8081B	Dieldrin
GC-ECD	EPA 8081A/8081B	Endosulfan I
GC-ECD	EPA 8081A/8081B	Endosulfan II
GC-ECD	EPA 8081A/8081B	Endosulfan sulfate
GC-ECD	EPA 8081A/8081B	Endrin
GC-ECD	EPA 8081A/8081B	Endrin aldehyde
GC-ECD	EPA 8081A/8081B	Endrin ketone
GC-ECD	EPA 8081A/8081B	Heptachlor
GC-ECD	EPA 8081A/8081B	Heptachlor epoxide
GC-ECD	EPA 8081A/8081B	Methoxychlor
GC-ECD	EPA 8081A/8081B	Toxaphene
GC-ECD	EPA 8082/8082A	Aroclor 1016
GC-ECD	EPA 8082/8082A	Aroclor 1221
GC-ECD	EPA 8082/8082A	Aroclor 1232
GC-ECD	EPA 8082/8082A	Aroclor 1242
GC-ECD	EPA 8082/8082A	Aroclor 1248
GC-ECD	EPA 8082/8082A	Aroclor 1254
GC-ECD	EPA 8082/8082A	Aroclor 1260
GC-ECD	EPA 8082/8082A	Aroclor 1262
GC-ECD	EPA 8082/8082A	Aroclor 1268
HPLC	EPA 8330A/8330B	2-Amino-4,6-dinitrotoluene
HPLC	EPA 8330A/8330B	4-Amino-2,6-dinitrotoluene
HPLC	EPA 8330A/8330B	1,3-Dinitrobenzene
HPLC	EPA 8330A/8330B	2,4-Dinitrotoluene
HPLC	EPA 8330A/8330B	2,6-Dinitrotoluene
HPLC	EPA 8330A/8330B	HMX
HPLC	EPA 8330A/8330B	HNAB
HPLC	EPA 8330A/8330B	HNS
HPLC	EPA 8330A/8330B	Nitrobenzene

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
HPLC	EPA 8330A/8330B	Nitroglycerin
HPLC	EPA 8330A/8330B	2-Nitrotoluene
HPLC	EPA 8330A/8330B	3-Nitrotoluene
HPLC	EPA 8330A/8330B	4-Nitrotoluene
HPLC	EPA 8330A/8330B	PETN
HPLC	EPA 8330A/8330B	RDX
HPLC	EPA 8330A/8330B	TATB
HPLC	EPA 8330A/8330B	Tetryl
HPLC	EPA 8330A/8330B	MNX
HPLC	EPA 8330A/8330B	DNX
HPLC	EPA 8330A/8330B	TNX
HPLC	EPA 8330A/8330B	1,3,5-Trinitrobenzene
HPLC	EPA 8330A/8330B	2,4,6-Trinitrotoluene
GC/MS	EPA 8270C/8270D SIM	Acenaphthene
GC/MS	EPA 8270C/8270D SIM	Acenaphthylene
GC/MS	EPA 8270C/8270D SIM	Anthracene
GC/MS	EPA 8270C/8270D SIM	Benzo(a)anthracene
GC/MS	EPA 8270C/8270D SIM	Benzo(b)fluoranthene
GC/MS	EPA 8270C/8270D SIM	Benzo(k)fluoranthene
GC/MS	EPA 8270C/8270D SIM	Benzo(ghi)perylene
GC/MS	EPA 8270C/8270D SIM	Benzo(a)pyrene
GC/MS	EPA 8270C/8270D SIM	Chrysene
GC/MS	EPA 8270C/8270D SIM	Dibenz(a,h)anthracene
GC/MS	EPA 8270C/8270D SIM	Fluoranthene
GC/MS	EPA 8270C/8270D SIM	Fluorene
GC/MS	EPA 8270C/8270D SIM	Indeno(1,2,3-cd)pyrene
GC/MS	EPA 8270C/8270D SIM	Naphthalene
GC/MS	EPA 8270C/8270D SIM	Phenanthrene
GC/MS	EPA 8270C/8270D SIM	Pyrene
GC-FID	EPA 8015B	Diesel Range Organics
GC-FID	EPA 8015B	Motor Oil Range Organics
GC-FID	EPA 8015B	Gasoline Range Organics

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC-FID	EPA 8015B	Ethanol
GC-FID	EPA 8015B	Methanol
GC-FID	EPA 8015B	Ethylene glycol
GC-FID	EPA 8015B	Propylene glycol
ICP-MS	EPA 6020/6020A/6020B	Aluminum
ICP-MS	EPA 6020/6020A/6020B	Antimony
ICP-MS	EPA 6020/6020A/6020B	Arsenic
ICP-MS	EPA 6020/6020A/6020B	Barium
ICP-MS	EPA 6020/6020A/6020B	Beryllium
ICP-MS	EPA 6020/6020A/6020B	Bismuth
ICP-MS	EPA 6020/6020A/6020B	Boron
ICP-MS	EPA 6020/6020A/6020B	Cadmium
ICP-MS	EPA 6020/6020A/6020B	Calcium
ICP-MS	EPA 6020/6020A/6020B	Cerium
ICP-MS	EPA 6020/6020A/6020B	Cesium
ICP-MS	EPA 6020/6020A/6020B	Chromium
ICP-MS	EPA 6020/6020A/6020B	Cobalt
ICP-MS	EPA 6020/6020A/6020B	Copper
ICP-MS	EPA 6020/6020A/6020B	Gold
ICP-MS	EPA 6020/6020A/6020B	Hafnium
ICP-MS	EPA 6020/6020A/6020B	Iron
ICP-MS	EPA 6020/6020A/6020B	Lanthanum
ICP-MS	EPA 6020/6020A/6020B	Lead
ICP-MS	EPA 6020/6020A/6020B	Lithium
ICP-MS	EPA 6020/6020A/6020B	Magnesium
ICP-MS	EPA 6020/6020A/6020B	Manganese
ICP-MS	EPA 6020/6020A/6020B	Molybdenum
ICP-MS	EPA 6020/6020A/6020B	Neodymium
ICP-MS	EPA 6020/6020A/6020B	Nickel
ICP-MS	EPA 6020/6020A/6020B	Niobium
ICP-MS	EPA 6020/6020A/6020B	Palladium
ICP-MS	EPA 6020/6020A/6020B	Phosphorus

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
ICP-MS	EPA 6020/6020A/6020B	Platinum
ICP-MS	EPA 6020/6020A/6020B	Potassium
ICP-MS	EPA 6020/6020A/6020B	Praseodymium
ICP-MS	EPA 6020/6020A/6020B	Rhenium
ICP-MS	EPA 6020/6020A/6020B	Rhodium
ICP-MS	EPA 6020/6020A/6020B	Ruthenium
ICP-MS	EPA 6020/6020A/6020B	Samarium
ICP-MS	EPA 6020/6020A/6020B	Selenium
ICP-MS	EPA 6020/6020A/6020B	Silicon
ICP-MS	EPA 6020/6020A/6020B	Silver
ICP-MS	EPA 6020/6020A/6020B	Sodium
ICP-MS	EPA 6020/6020A/6020B	Strontium
ICP-MS	EPA 6020/6020A/6020B	Tantalum
ICP-MS	EPA 6020/6020A/6020B	Technetium-99
ICP-MS	EPA 6020/6020A/6020B	Tellurium
ICP-MS	EPA 6020/6020A/6020B	Thallium
ICP-MS	EPA 6020/6020A/6020B	Thorium
ICP-MS	EPA 6020/6020A/6020B	Tin
ICP-MS	EPA 6020/6020A/6020B	Titanium
ICP-MS	EPA 6020/6020A/6020B	Tungsten
ICP-MS	EPA 6020/6020A/6020B	Uranium
ICP-MS	EPA 6020/6020A/6020B	Uranium 233
ICP-MS	EPA 6020/6020A/6020B	Uranium 234
ICP-MS	EPA 6020/6020A/6020B	Uranium 235
ICP-MS	EPA 6020/6020A/6020B	Uranium 236
ICP-MS	EPA 6020/6020A/6020B	Uranium 238
ICP-MS	EPA 6020/6020A/6020B	Vanadium
ICP-MS	EPA 6020/6020A/6020B	Yttrium
ICP-MS	EPA 6020/6020A/6020B	Zinc
ICP-MS	EPA 6020/6020A/6020B	Zirconium
CVAA	EPA 7471A/7471B	Mercury
Colormetric	EPA 9010C EPA 9012A/9012B	Cyanide

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
Ion Chromatography	EPA 300.0 EPA 9056/9056A	Bromide
Ion Chromatography	EPA 300.0	Chloride
Ion Chromatography	EPA 9056/9056A	Fluoride
Ion Chromatography	EPA 300.0	Nitrate
Ion Chromatography	EPA 9056/9056A	Nitrite
Ion Chromatography	EPA 300.0	Sulfate
Ion Chromatography	EPA 9056/9056A	Ortho-phosph
Ion Chromatography	EPA 300.0	Iodide
Ion Chromatography	EPA 314.0	Perchlorate
Probe	EPA 9045C/D	pH
Titration	SM 2320B EPA 310.1	Alkalinity
Titration	EPA 9030B EPA 9034/9034A	Sulfide
Penske-Martin	EPA 1010/1010A	Ignitability
Colormetric	EPA 353.1	nitrate/Nitrite
Colormetric	EPA 350.1	Ammonia
TOC Analyzer	EPA 9060A	TOC
Colormetric	EPA 7196A	Hex Chromium
Gravimetric	EPA 1664A	Oil & Grease
Gravimetric	EPA 1664A	TPH
Probe	EPA 9050A	Conductivity
Gas Flow Proportional Counter	EPA 900.0 EPA 9310	gross alpha/beta
Gas Flow Proportional Counter	EPA 903.0 EPA 9315	Radium-226
Gas Flow Proportional Counter	EPA 903.0 EPA 9315	total radium
Gas Flow Proportional Counter	EPA 904.0 EPA 9320	Radium-228
Gas Flow Proportional Counter	EPA 905.0 DOE HASL 300 Sr-02 DOE HASL 300 Sr-03	Strontium-90
Liquid Scintillation Counter	EPA 906.0	Tritium

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
Liquid Scintillation Counter	Eichrom Technologies TCW01/TCS01	Tecnetium-99
Liquid Scintillation Counter	EERF C-01-C14	Carbon-14
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Gamma Emitters:
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Actinium 227 (assumes equilibrium w/ Th-227)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Actinium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Americium 241
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Antimony 124
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Antimony 125
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium-137
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium/Lanthanum-140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium 133
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium 140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Beryllium 7
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 211 eq Th-227
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 207
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth-210M
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 212
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 214
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Calcium-45
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 141

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 139
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 144
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cesium 134
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cesium 137
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 56
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 57
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 58
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 60
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 152
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 154
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 155
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Hafnium 181
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iodine 131
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iridium 192
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iron 59
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lanthanum 140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 210
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 211
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 212
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 214

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Manganese-56
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Manganese 54
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Mercury 203
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Neptunium 237
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Neptunium 239
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Niobium 83
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Niobium 94
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Niobium 95
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Potassium 40
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 144
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 146
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 147
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 234M
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 231
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 234
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium (226)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 223 (assumes equilibrium w/ Th-227)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 224
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Ruthenium 106

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Scandium 46
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Sodium 22
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Sodium 24
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Strontium 85
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thallium 208
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 227
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 230
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 231
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 232
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 234
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Tin 113
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Uranium 235
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Uranium 238
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Vanadium-48
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Yttrium 88
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Zinc 65
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Zirconium 95
Alpha Spectroscopy	DOE HASL 300 A-01-R	Alpha spec analysis:
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Uranium
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Thorium
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Americium

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Solid and Chemical Materials		
Technology	**Method**	**Analyte**
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Plutonium
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Neptunium
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Curium
Liquid Scintillation Counter	Eichrom Technologies OTW01, OTS01	Lead-210
Alpha Spectroscopy	Laboratory SOP ST-RC-0210	Polonium-210
Liquid Scintillation Counter	Eichrom Technologies FEW01	Iron-55
Liquid Scintillation Counter	DOE RP-300	Nickel 59/63
Liquid Scintillation Counter	SM 7500-IB	Iodine-129
Preparation	**Method**	**Type**
Organic Extraction & Sample Prep	EPA 3500C	Organic Extraction & Sample Prep
Volatile Prep	EPA 5000	Sample Preparation for Volatile Organic Compounds
Organic Cleanup	EPA 3600A	Cleanup for Organic extracts
Organic prep/analysis	EPA 8000C	Determinative Chromatographic Separations
Acid Digestion (Aqueous samples)	EPA 3010A	Acid Digestion for Metals (Aqueous samples)
Acid Digestion (solids)	EPA 3050B	Acid Digestion for Metals of Sedimtent/Soils
Purge & Trap	EPA 5030C	Purge & Trap for Aqueous Volatile Samples
Closed System Purge & Trap and Extraction for Volatiles	EPA 5035A	Closed System Purge & Trap and Extraction for Volatiles
Sep Funnel Liquid-Liquid Extraction	EPA 3510C	Sep Funnel Liquid-Liquid Extraction
Ultrasonic Extraction	EPA 3550C	Ultrasonic Extraction Organic Soils
Solid Phase Extraction	EPA 3535A	Solid Phase Extraction
Acid Clean-up	EPA 3665A	Acid Clean Up for PCBs
Florisil Cleanup	EPA 3620C	Florisil Cleanup
Sulfur Cleanup	EPA 3660B	Sulfur Cleanup
Waste Dilution	EPA 3585	Waste Dilution Volatile Organics
Waste Dilution	EPA 3580A	Waste Dilution SemiVolatile Organics
TCLP Extraction	EPA 1311	TCLP Extraction
SPLP Extraction	EPA 1312	SPLP Extraction

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
CWET Extraction	CA Title 22	CWET Extraction
Alkaline Digestion	EPA 3060A	Alkaline Digestion for Hexavalent Chromium
Liquid Scintillation Counter	Eichrom Technologies FEW01	Iron-55

Note:

1. This scope is formatted as part of a single document including Certificate of Accreditation No. L2305

Vice President

CALIFORNIA
Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

CERTIFICATE OF ENVIRONMENTAL ACCREDITATION

Is hereby granted to

TestAmerica St. Louis

13715 Rider Trail North

Earth City, MO 63045

Scope of the certificate is limited to the
"Fields of Testing"
which accompany this Certificate.

Continued accredited status depends on successful completion of on-site inspection, proficiency testing studies, and payment of applicable fees.

This Certificate is granted in accordance with provisions of Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **2886**

Expiration Date: **6/30/2019**

Effective Date: **7/1/2018**

Sacramento, California
subject to forfeiture or revocation

Christine Sotelo, Chief
Environmental Laboratory Accreditation Program

CALIFORNIA STATE
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM
Accredited Fields of Testing

TestAmerica St. Louis

13715 Rider Trail North
Earth City, MO 63045
Phone: (314) 298-8566

Certificate No. 2886
Expiration Date 6/30/2019

Field of Testing: 106 - Radiochemistry of Drinking Water

106.010	001	Gross Alpha	EPA 900.0
106.010	002	Gross Beta	EPA 900.0
106.030	001	Radioactive Cesium	EPA 901.1
106.030	003	Gamma Emitters	EPA 901.1
106.050	001	Total Alpha Radium	EPA 903.0
106.050	002	Radium-226 (estimate)	EPA 903.0
106.060	001	Radium-228	EPA 904.0
106.070	003	Strontium-90	EPA 905.0
106.080	001	Tritium	EPA 906.0
106.220	001	Strontium-89, 90	DOE Sr-01
106.230	001	Isotopic Uranium	DOE U-02
106.270	001	Gross Alpha by Coprecipitation	SM7110 C

Field of Testing: 108 - Inorganic Chemistry of Wastewater

108.020	001	Conductivity	EPA 120.1
108.112	001	Boron	EPA 200.7
108.112	002	Calcium	EPA 200.7
108.112	004	Magnesium	EPA 200.7
108.112	005	Potassium	EPA 200.7
108.112	007	Sodium	EPA 200.7
108.113	001	Boron	EPA 200.8
108.113	002	Calcium	EPA 200.8
108.113	003	Magnesium	EPA 200.8
108.113	004	Potassium	EPA 200.8
108.113	006	Sodium	EPA 200.8
108.120	001	Bromide	EPA 300.0
108.120	002	Chloride	EPA 300.0
108.120	003	Fluoride	EPA 300.0
108.120	008	Sulfate	EPA 300.0
108.120	012	Nitrate (as N)	EPA 300.0
108.120	014	Nitrite (as N)	EPA 300.0
108.120	015	Phosphate, Ortho (as P)	EPA 300.0
108.183	001	Cyanide, Total	EPA 335.4
108.209	001	Ammonia (as N)	EPA 350.1
108.211	002	Kjeldahl Nitrogen, Total (as N)	EPA 351.2
108.323	001	Chemical Oxygen Demand	EPA 410.4
108.381	001	Oil and Grease	EPA 1664A
108.440	001	Residue, Total	SM2540B-1997
108.441	001	Residue, Filterable TDS	SM2540C-1997

As of 6/28/2018 , this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

108.442	001	Residue, Non-filterable TSS	SM2540D-1997
108.490	001	Hydrogen Ion (pH)	SM4500-H+ B-2000

Field of Testing: 109 - Toxic Chemical Elements of Wastewater

109.010	001	Aluminum	EPA 200.7
109.010	002	Antimony	EPA 200.7
109.010	003	Arsenic	EPA 200.7
109.010	004	Barium	EPA 200.7
109.010	005	Beryllium	EPA 200.7
109.010	006	Boron	EPA 200.7
109.010	007	Cadmium	EPA 200.7
109.010	009	Chromium	EPA 200.7
109.010	010	Cobalt	EPA 200.7
109.010	011	Copper	EPA 200.7
109.010	012	Iron	EPA 200.7
109.010	013	Lead	EPA 200.7
109.010	015	Manganese	EPA 200.7
109.010	016	Molybdenum	EPA 200.7
109.010	017	Nickel	EPA 200.7
109.010	019	Selenium	EPA 200.7
109.010	021	Silver	EPA 200.7
109.010	023	Thallium	EPA 200.7
109.010	024	Tin	EPA 200.7
109.010	025	Titanium	EPA 200.7
109.010	026	Vanadium	EPA 200.7
109.010	027	Zinc	EPA 200.7
109.020	001	Aluminum	EPA 200.8
109.020	002	Antimony	EPA 200.8
109.020	003	Arsenic	EPA 200.8
109.020	004	Barium	EPA 200.8
109.020	005	Beryllium	EPA 200.8
109.020	006	Cadmium	EPA 200.8
109.020	007	Chromium	EPA 200.8
109.020	008	Cobalt	EPA 200.8
109.020	009	Copper	EPA 200.8
109.020	010	Lead	EPA 200.8
109.020	011	Manganese	EPA 200.8
109.020	012	Molybdenum	EPA 200.8
109.020	013	Nickel	EPA 200.8
109.020	014	Selenium	EPA 200.8
109.020	015	Silver	EPA 200.8
109.020	016	Thallium	EPA 200.8
109.020	017	Vanadium	EPA 200.8
109.020	018	Zinc	EPA 200.8
109.020	021	Iron	EPA 200.8
109.020	022	Tin	EPA 200.8
109.020	023	Titanium	EPA 200.8
109.190	001	Mercury	EPA 245.1

Field of Testing: 110 - Volatile Organic Chemistry of Wastewater

110.040	000	Purgeable Organic Compounds	EPA 624

Field of Testing: 111 - Semi-volatile Organic Chemistry of Wastewater

111.100	000	Base/Neutral & Acid Organics	EPA 625
111.170	000	Organochlorine Pesticides and PCBs	EPA 608

Field of Testing: 112 - Radiochemistry of Wastewater

112.010	001	Gross Alpha	EPA 900.0
112.010	002	Gross Beta	EPA 900.0
112.020	001	Total Alpha Radium	EPA 903.0
112.140	001	Cesium	EPA 901.1
112.140	002	Gamma	EPA 901.1
112.160	001	Radium-228	EPA 904.0
112.170	001	Strontium	EPA 905.0
112.180	001	Tritium	EPA 906.0
112.510	001	Strontium	DOE Sr-02
112.520	001	Isotopic Uranium	DOE U-02

Field of Testing: 114 - Inorganic Chemistry of Hazardous Waste

114.010	001	Antimony	EPA 6010B
114.010	002	Arsenic	EPA 6010B
114.010	003	Barium	EPA 6010B
114.010	004	Beryllium	EPA 6010B
114.010	005	Cadmium	EPA 6010B
114.010	006	Chromium	EPA 6010B
114.010	007	Cobalt	EPA 6010B
114.010	008	Copper	EPA 6010B
114.010	009	Lead	EPA 6010B
114.010	010	Molybdenum	EPA 6010B
114.010	011	Nickel	EPA 6010B
114.010	012	Selenium	EPA 6010B
114.010	013	Silver	EPA 6010B
114.010	014	Thallium	EPA 6010B
114.010	015	Vanadium	EPA 6010B
114.010	016	Zinc	EPA 6010B
114.020	001	Antimony	EPA 6020
114.020	002	Arsenic	EPA 6020
114.020	003	Barium	EPA 6020
114.020	004	Beryllium	EPA 6020
114.020	005	Cadmium	EPA 6020
114.020	006	Chromium	EPA 6020
114.020	007	Cobalt	EPA 6020
114.020	008	Copper	EPA 6020
114.020	009	Lead	EPA 6020
114.020	010	Molybdenum	EPA 6020
114.020	011	Nickel	EPA 6020
114.020	012	Selenium	EPA 6020
114.020	013	Silver	EPA 6020

114.020	014	Thallium	EPA 6020	
114.020	015	Vanadium	EPA 6020	
114.020	016	Zinc	EPA 6020	
114.103	001	Chromium (VI)	EPA 7196A	
114.140	001	Mercury	EPA 7470A	Aqueous Only
114.141	001	Mercury	EPA 7471A	
114.221	001	Cyanide, Total	EPA 9012A	
114.240	001	Corrosivity - pH Determination	EPA 9040B	
114.241	001	Corrosivity - pH Determination	EPA 9045C	
114.250	001	Fluoride	EPA 9056	

Field of Testing: 115 - Extraction Test of Hazardous Waste

115.020	001	Toxicity Characteristic Leaching Procedure (TC	EPA 1311 (TCLP)
115.021	001	TCLP Inorganics	EPA 1311 (TCLP)
115.022	001	TCLP Extractables	EPA 1311 (TCLP)
115.023	001	TCLP Volatiles	EPA 1311 (TCLP)
115.030	001	Waste Extraction Test (WET)	CCR Chapter11, Article 5, Appendix II
115.040	001	Synthetic Precipitation Leaching Procedure (S	EPA 1312 (SPLP)

Field of Testing: 116 - Volatile Organic Chemistry of Hazardous Waste

116.030	001	Gasoline-range Organics	EPA 8015B
116.080	000	Volatile Organic Compounds	EPA 8260B

Field of Testing: 117 - Semi-volatile Organic Chemistry of Hazardous Waste

117.010	001	Diesel-range Total Petroleum Hydrocarbons	EPA 8015B
117.110	000	Extractable Organics	EPA 8270C
117.171	000	Nitroaromatics and Nitramines	EPA 8330A
117.210	000	Organochlorine Pesticides	EPA 8081A
117.220	000	PCBs	EPA 8082

Field of Testing: 118 - Radiochemistry of Hazardous Waste

118.010	001	Gross Alpha	EPA 9310
118.010	002	Gross Beta	EPA 9310
118.020	001	Radium, Total	EPA 9315
118.030	001	Radium-228	EPA 9320
118.271	001	Strontium	DOE Sr-02

Field of Testing: 120 - Physical Properties of Hazardous Waste

120.010	001	Ignitability	EPA 1010
120.040	001	Reactive Cyanide	Section 7.3 SW-846
120.050	001	Reactive Sulfide	Section 7.3 SW-846
120.070	001	Corrosivity - pH Determination	EPA 9040B
120.080	001	Corrosivity - pH Determination	EPA 9045C

CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board
500 Montgomery Street, Suite 625, Alexandria, VA 22314, 877-344-3044

This is to certify that

TestAmerica Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

has been assessed by ANAB
and meets the requirements of international standard

ISO/IEC 17025:2005

and DoD Quality Systems Manual for Environmental Laboratories (DoD QSM V 5.1)

while demonstrating technical competence in the fields of

TESTING

Refer to the accompanying Scope of Accreditation for information regarding the types of calibrations and/or tests to which this accreditation applies.

L2468
Certificate Number

ANAB Approval

Certificate Valid: 03/22/2018-01/20/2021
Version No. 003 Issued: 03/22/2018

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

ANSI-ASQ National Accreditation Board

ANAB

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005 AND DOD QUALITY SYSTEMS MAUAL FOR ENVIRONMENTAL LABORATORIES (DOD QSM V5.1)

TestAmerica Sacramento

880 Riverside Parkway
West Sacramento, CA 95605
Ms. Lisa Stafford
916-373-5600

TESTING

Valid to: **January 20, 2021** Certificate Number: **L2468**

Environmental

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-AES	EPA 6010B/6010C	Aluminum
ICP-AES	EPA 6010B/6010C	Antimony
ICP-AES	EPA 6010B/6010C	Arsenic
ICP-AES	EPA 6010B/6010C	Barium
ICP-AES	EPA 6010B/6010C	Beryllium
ICP-AES	EPA 6010B/6010C	Boron
ICP-AES	EPA 6010B/6010C	Cadmium
ICP-AES	EPA 6010B/6010C	Calcium
ICP-AES	EPA 6010B/6010C	Chromium (Total)
ICP-AES	EPA 6010B/6010C	Cobalt
ICP-AES	EPA 6010B/6010C	Copper
ICP-AES	EPA 6010B/6010C	Iron
ICP-AES	EPA 6010B/6010C	Lead
ICP-AES	EPA 6010B/6010C	Magnesium
ICP-AES	EPA 6010B/6010C	Manganese
ICP-AES	EPA 6010B/6010C	Molybdenum
ICP-AES	EPA 6010B/6010C	Nickel
ICP-AES	EPA 6010B/6010C	Potassium
ICP-AES	EPA 6010B/6010C	Selenium
ICP-AES	EPA 6010B/6010C	Silica

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-AES	EPA 6010B/6010C	Silicon
ICP-AES	EPA 6010B/6010C	Silver
ICP-AES	EPA 6010B/6010C	Sodium
ICP-AES	EPA 6010B/6010C	Thallium
ICP-AES	EPA 6010B/6010C	Tin
ICP-AES	EPA 6010B/6010C	Titanium
ICP-AES	EPA 6010B/6010C	Vanadium
ICP-AES	EPA 6010B/6010C	Zinc
ICP-MS	EPA 6020/6020A	Aluminum
ICP-MS	EPA 6020/6020A	Antimony
ICP-MS	EPA 6020/6020A	Arsenic
ICP-MS	EPA 6020/6020A	Barium
ICP-MS	EPA 6020/6020A	Beryllium
ICP-MS	EPA 6020/6020A	Cadmium
ICP-MS	EPA 6020/6020A	Calcium
ICP-MS	EPA 6020/6020A	Chromium (Total)
ICP-MS	EPA 6020/6020A	Cobalt
ICP-MS	EPA 6020/6020A	Copper
ICP-MS	EPA 6020/6020A	Iron
ICP-MS	EPA 6020/6020A	Lead
ICP-MS	EPA 6020/6020A	Magnesium
ICP-MS	EPA 6020/6020A	Manganese
ICP-MS	EPA 6020/6020A	Molybdenum
ICP-MS	EPA 6020/6020A	Nickel
ICP-MS	EPA 6020/6020A	Phosphorus
ICP-MS	EPA 6020/6020A	Potassium
ICP-MS	EPA 6020/6020A	Selenium
ICP-MS	EPA 6020/6020A	Silver
ICP-MS	EPA 6020/6020A	Sodium
ICP-MS	EPA 6020/6020A	Strontium
ICP-MS	EPA 6020/6020A	Thallium
ICP-MS	EPA 6020/6020A	Tin
ICP-MS	EPA 6020/6020A	Titanium
ICP-MS	EPA 6020/6020A	Uranium
ICP-MS	EPA 6020/6020A	Vanadium
ICP-MS	EPA 6020/6020A	Zinc

Non-Potable Water		
Technology	**Method**	**Analyte**
CVAAS	EPA 7470A	Mercury
Colorimetric	EPA 353.2	Nitrate
Colorimetric	EPA 353.2	Nitrate-nitrite
Colorimetric	EPA 353.2	Nitrite
Colorimetric	EPA 410.4	Chemical Oxygen Demand (COD)
LC/MS/MS	EPA 6850	Perchlorate
Colorimetric	EPA 7196A	Chromium (Hexavalent)
Probe	EPA 9040B/9040C	pH
Ion Chromatography	EPA 9056A/300.0	Bromide
Ion Chromatography	EPA 9056A/300.0	Chloride
Ion Chromatography	EPA 9056A/300.0	Fluoride
Ion Chromatography	EPA 9056A/300.0	Nitrate
Ion Chromatography	EPA 9056A/300.0	Nitrite
Ion Chromatography	EPA 9056A/300.0	Orthophosphate
Ion Chromatography	EPA 9056A/300.0	Sulfate
Titration	SM 2320B	Alkalinity
Gravimetric	SM 2540B	Solids, Total
Gravimetric	SM 2540C	Solids, Total Dissolved
Gravimetric	SM 2540D	Solids, Total Suspended
Colorimetric/Hydrolysis	EPA 353.2 Modified / WS-WC-0050	Nitrocellulose
GC/MS	EPA 8260B/8260C	1,1,1,2-Tetrachloroethane
GC/MS	EPA 8260B/8260C	1,1,1-Trichloroethane
GC/MS	EPA 8260B/8260C	1,1,2,2-Tetrachloroethane
GC/MS	EPA 8260B/8260C	1,1,2-Trichloroethane
GC/MS	EPA 8260B/8260C	1,1,2-Trichloro-1,2,2-trifluoroethane
GC/MS	EPA 8260B/8260C	1,1-Dichloroethane
GC/MS	EPA 8260B/8260C	1,1-Dichloroethene
GC/MS	EPA 8260B/8260C	1,1-Dichloropropene
GC/MS	EPA 8260B/8260C	1,2,3-Trichlorobenzene
GC/MS	EPA 8260B/8260C	1,2,3-Trichloropropane
GC/MS	EPA 8260B/8260C	1,2,4-Trichlorobenzene
GC/MS	EPA 8260B/8260C	1,2,4-Trimethylbenzene
GC/MS	EPA 8260B/8260C	1,2-Dibromo-3-chloropropane
GC/MS	EPA 8260B/8260C	1,2-Dibromoethane
GC/MS	EPA 8260B/8260C	1,2-Dichlorobenzene
GC/MS	EPA 8260B/8260C	1,2-Dichloroethane

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/8260C	1,2-Dichloropropane
GC/MS	EPA 8260B/8260C	1,3,5-Trimethylbenzene
GC/MS	EPA 8260B/8260C	1,3-Dichlorobenzene
GC/MS	EPA 8260B/8260C	1,3-Dichloropropane
GC/MS	EPA 8260B/8260C	1,4-Dichlorobenzene
GC/MS	EPA 8260B/8260C	1-Chlorohexane
GC/MS	EPA 8260B/8260C	2,2-Dichloropropane
GC/MS	EPA 8260B/8260C	2-Butanone (MEK)
GC/MS	EPA 8260B/8260C	2-Chlorotoluene
GC/MS	EPA 8260B/8260C	2-Hexanone (MBK)
GC/MS	EPA 8260B/8260C	2-Methyl-2-propanol (tert- Butyl Alcohol, TBA)
GC/MS	EPA 8260B/8260C	4-Chlorotoluene
GC/MS	EPA 8260B/8260C	4-Isopropyltoluene
GC/MS	EPA 8260B/8260C	4-Methyl-2-pentanone (MIBK)
GC/MS	EPA 8260B/8260C	Acetone
GC/MS	EPA 8260B/8260C	Allyl Chloride
GC/MS	EPA 8260B/8260C	Benzene
GC/MS	EPA 8260B/8260C	Bromobenzene
GC/MS	EPA 8260B/8260C	Bromochloromethane
GC/MS	EPA 8260B/8260C	Bromodichloromethane
GC/MS	EPA 8260B/8260C	Bromoform
GC/MS	EPA 8260B/8260C	Bromomethane
GC/MS	EPA 8260B/8260C	Carbon Disulfide
GC/MS	EPA 8260B/8260C	Carbon Tetrachloride
GC/MS	EPA 8260B/8260C	Chlorobenzene
GC/MS	EPA 8260B/8260C	Chloroethane
GC/MS	EPA 8260B/8260C	Chloroform
GC/MS	EPA 8260B/8260C	Chloromethane
GC/MS	EPA 8260B/8260C	cis-1,2-Dichloroethene
GC/MS	EPA 8260B/8260C	cis-1,3-Dichloropropene
GC/MS	EPA 8260B/8260C	Cyclohexane
GC/MS	EPA 8260B/8260C	Dibromochloromethane
GC/MS	EPA 8260B/8260C	Dibromomethane
GC/MS	EPA 8260B/8260C	Dichlorodifluoromethane
GC/MS	EPA 8260B/8260C	Diisopropyl Ether (DIPE)
GC/MS	EPA 8260B/8260C	Ethylbenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/8260C	Ethylmethacrylate
GC/MS	EPA 8260B/8260C	Ethyl tert-butyl Ether (ETBE)
GC/MS	EPA 8260B/8260C	Hexachlorobutadiene
GC/MS	EPA 8260B/8260C	Hexane
GC/MS	EPA 8260B/8260C	Iodomethane
GC/MS	EPA 8260B/8260C	Isobutanol (2-Methyl-1-propanol)
GC/MS	EPA 8260B/8260C	Isopropylbenzene
GC/MS	EPA 8260B/8260C	m & p Xylene
GC/MS	EPA 8260B/8260C	Methyl tert-butyl Ether (MTBE)
GC/MS	EPA 8260B/8260C	Methylene Chloride
GC/MS	EPA 8260B/8260C	Naphthalene
GC/MS	EPA 8260B/8260C	n-Butylbenzene
GC/MS	EPA 8260B/8260C	n-Propylbenzene
GC/MS	EPA 8260B/8260C	o-Xylene
GC/MS	EPA 8260B/8260C	sec-Butylbenzene
GC/MS	EPA 8260B/8260C	Styrene
GC/MS	EPA 8260B/8260C	t-Amyl methyl Ether (TAME)
GC/MS	EPA 8260B/8260C	t-1,4-Dichloro-2-Butene
GC/MS	EPA 8260B/8260C	tert-Butylbenzene
GC/MS	EPA 8260B/8260C	Tetrachloroethene
GC/MS	EPA 8260B/8260C	Toluene
GC/MS	EPA 8260B/8260C	trans-1,2-Dichloroethene
GC/MS	EPA 8260B/8260C	trans-1,3-Dichloropropene
GC/MS	EPA 8260B/8260C	Trichloroethene
GC/MS	EPA 8260B/8260C	Trichlorofluoromethane
GC/MS	EPA 8260B/8260C	Vinyl Acetate
GC/MS	EPA 8260B/8260C	Vinyl Chloride
GC/MS	EPA 8260B/8260C	Xylenes, Total
GC/MS	EPA 8260B/AK101MS	Gasoline (GRO)
GC/MS	EPA 8270C/8270D	1,2,4,5-Tetrachlorobenzene
GC/MS	EPA 8270C/8270D	1,2,4-Trichlorobenzene
GC/MS	EPA 8270C/8270D	1,2-Dichlorobenzene
GC/MS	EPA 8270C/8270D	1,2-Diphenylhydrazine (as Azobenzene)
GC/MS	EPA 8270C/8270D	1,3-Dichlorobenzene
GC/MS	EPA 8270C/8270D	1,3-Dinitrobenzene
GC/MS	EPA 8270C/8270D	1,4-Dichlorobenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/8270D	1-Methylnaphthalene
GC/MS	EPA 8270C/8270D	2,3,4,6-Tetrachlorophenol
GC/MS	EPA 8270C/8270D	2,4,5-Trichlorophenol
GC/MS	EPA 8270C/8270D	2,4,6-Trichlorophenol
GC/MS	EPA 8270C/8270D	2,4-Dichlorophenol
GC/MS	EPA 8270C/8270D	2,4-Dimethylphenol
GC/MS	EPA 8270C/8270D	2,4-Dinitrophenol
GC/MS	EPA 8270C/8270D	2,4-Dinitrotoluene
GC/MS	EPA 8270C/8270D	2,6-Dichlorophenol
GC/MS	EPA 8270C/8270D	2,6-Dinitrotoluene
GC/MS	EPA 8270C/8270D	2-Chloronaphthalene
GC/MS	EPA 8270C/8270D	2-Chlorophenol
GC/MS	EPA 8270C/8270D	2-Methylnaphthalene
GC/MS	EPA 8270C/8270D	2-Methylphenol
GC/MS	EPA 8270C/8270D	2-Nitroaniline
GC/MS	EPA 8270C/8270D	2-Nitrophenol
GC/MS	EPA 8270C/8270D	3&4-Methylphenol
GC/MS	EPA 8270C/8270D	3,3'-Dichlorobenzidine
GC/MS	EPA 8270C/8270D	3-Nitroaniline
GC/MS	EPA 8270C/8270D	4,6-Dinitro-2-methylphenol
GC/MS	EPA 8270C/8270D	4-Bromophenyl phenyl ether
GC/MS	EPA 8270C/8270D	4-Chloro-3-methylphenol
GC/MS	EPA 8270C/8270D	4-Chloroaniline
GC/MS	EPA 8270C/8270D	4-Chlorophenyl phenyl ether
GC/MS	EPA 8270C/8270D	4-Nitroaniline
GC/MS	EPA 8270C/8270D	4-Nitrophenol
GC/MS	EPA 8270C/8270D	Acenaphthene
GC/MS	EPA 8270C/8270D	Acenaphthylene
GC/MS	EPA 8270C/8270D	Aniline
GC/MS	EPA 8270C/8270D	Anthracene
GC/MS	EPA 8270C/8270D	Benzo(a)anthracene
GC/MS	EPA 8270C/8270D	Benzo(a)pyrene
GC/MS	EPA 8270C/8270D	Benzo(b)fluoranthene
GC/MS	EPA 8270C/8270D	Benzo(g,h,i)perylene
GC/MS	EPA 8270C/8270D	Benzo(k)fluoranthene
GC/MS	EPA 8270C/8270D	Benzoic Acid

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Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/8270D	Benzyl Alcohol
GC/MS	EPA 8270C/8270D	Benzyl butyl Phthalate
GC/MS	EPA 8270C/8270D	Biphenyl
GC/MS	EPA 8270C/8270D	Bis(2-chloroethoxy) Methane
GC/MS	EPA 8270C/8270D	Bis(2-chloroethyl) Ether
GC/MS	EPA 8270C/8270D	Bis(2-chloroisopropyl) Ether
GC/MS	EPA 8270C/8270D	Carbazole
GC/MS	EPA 8270C/8270D	Chrysene
GC/MS	EPA 8270C/8270D	Bis (2-ethylhexyl) Phthalate
GC/MS	EPA 8270C/8270D	Dibenz(a,h)anthracene
GC/MS	EPA 8270C/8270D	Dibenzofuran
GC/MS	EPA 8270C/8270D	Diethyl Phthalate
GC/MS	EPA 8270C/8270D	Dimethyl Phthalate
GC/MS	EPA 8270C/8270D	Di-n-butyl Phthalate
GC/MS	EPA 8270C/8270D	Di-n-octyl Phthalate
GC/MS	EPA 8270C/8270D	Fluoranthene
GC/MS	EPA 8270C/8270D	Fluorene
GC/MS	EPA 8270C/8270D	Hexachlorobenzene
GC/MS	EPA 8270C/8270D	Hexachlorobutadiene
GC/MS	EPA 8270C/8270D	Hexachlorocyclopentadiene
GC/MS	EPA 8270C/8270D	Hexachloroethane
GC/MS	EPA 8270C/8270D	Indeno(1,2,3-c,d) Pyrene
GC/MS	EPA 8270C/8270D	Isophorone
GC/MS	EPA 8270C/8270D	Naphthalene
GC/MS	EPA 8270C/8270D	Nitrobenzene
GC/MS	EPA 8270C/8270D	n-Nitrosodimethylamine
GC/MS	EPA 8270C/8270D	n-Nitrosodi-n-propylamine
GC/MS	EPA 8270C/8270D	n-Nitrosodiphenylamine
GC/MS	EPA 8270C/8270D	Pentachlorophenol
GC/MS	EPA 8270C/8270D	Phenanthrene
GC/MS	EPA 8270C/8270D	Phenol
GC/MS	EPA 8270C/8270D	Pyrene
GC/MS	EPA 8270C/8270D	Pyridine
GC/MS SIM	EPA 8260C-SIM	1,1,2-Trichloroethane
GC/MS SIM	EPA 8260C-SIM	1,1,2,2-Tetrachloroethane
GC/MS SIM	EPA 8260C-SIM	1,2,3-Trichloropropane

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS SIM	EPA 8260C-SIM	1,2-Dibromoethane
GC/MS SIM	EPA 8260C-SIM	1,2-Dichloroethane
GC/MS SIM	EPA 8260C-SIM	1,3-Butadiene
GC/MS SIM	EPA 8260C-SIM	1,4-Dichlorobenzene
GC/MS SIM	EPA 8260C-SIM	Benzene
GC/MS SIM	EPA 8260C-SIM	Bromodichloromethane
GC/MS SIM	EPA 8260C-SIM	Bromoform
GC/MS SIM	EPA 8260C-SIM	Bromomethane
GC/MS SIM	EPA 8260C-SIM	Chloroform
GC/MS SIM	EPA 8260C-SIM	Dibromochloromethane
GC/MS SIM	EPA 8260C-SIM	Hexachlorobutadiene
GC/MS SIM	EPA 8260C-SIM	Naphthalene
GC/MS SIM	EPA 8260C-SIM	Tetrachloroethene
GC/MS SIM	EPA 8260C-SIM	Trichloroethene
GC/MS SIM	EPA 8260C-SIM	Vinyl Chloride
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	1-Methylnaphthalene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	2-Methylnaphthalene
GC/MS SIM	EPA 8270D-SIM	3,3'-Dichlorobenzidine
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Acenaphthene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Acenaphthylene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Anthracene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Benzo(a)anthracene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Benzo(a)pyrene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Benzo(b)fluoranthene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Benzo(g,h,i)perylene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Benzo(k)fluoranthene
GC/MS SIM	EPA 8270D-SIM	Bis(2-chloroethyl) Ether
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Chrysene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Dibenz(a,h)anthracene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Fluoranthene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Fluorene
GC/MS SIM	EPA 8270D-SIM	Hexachlorobenzene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Indeno(1,2,3-c,d) Pyrene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Naphthalene
GC/MS SIM	EPA 8270D-SIM	n-Nitrosodimethylamine
GC/MS SIM	EPA 8270D-SIM	n-Nitrosodi-n-propylamine
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Phenanthrene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Pyrene
GC/MS SIM	EPA 8270C-SIM Modified / WS-MS-0011	1,4-Dioxane
GC-IT/MS	EPA 521 Modified / WS-MS-0012	N-Nitrosodimethyl amine (NDMA)
GC-FID	EPA 8015B/8015C/8015D AK102	Diesel Range Organics (DRO)
GC-FID	AK103	Residual Range Organics
GC-FID	EPA 8015B/8015C/8015D	Motor Oil Range Organics (MRO)
GC-ECD	EPA 8081A/8081B	Aldrin
GC-ECD	EPA 8081A/8081B	a-BHC
GC-ECD	EPA 8081A/8081B	b-BHC
GC-ECD	EPA 8081A/8081B	d-BHC
GC-ECD	EPA 8081A/8081B	g-BHC (Lindane)
GC-ECD	EPA 8081A/8081B	a-Chlordane
GC-ECD	EPA 8081A/8081B	g-Chlordane
GC-ECD	EPA 8081A/8081B	4,4'-DDD
GC-ECD	EPA 8081A/8081B	4,4'-DDE
GC-ECD	EPA 8081A/8081B	4,4'-DDT
GC-ECD	EPA 8081A/8081B	Dieldrin
GC-ECD	EPA 8081A/8081B	Endosulfan I
GC-ECD	EPA 8081A/8081B	Endosulfan II
GC-ECD	EPA 8081A/8081B	Endosulfan sulfate

Non-Potable Water		
Technology	**Method**	**Analyte**
GC-ECD	EPA 8081A/8081B	Endrin
GC-ECD	EPA 8081A/8081B	Endrin Aldehyde
GC-ECD	EPA 8081A/8081B	Endrin Ketone
GC-ECD	EPA 8081A/8081B	Heptachlor
GC-ECD	EPA 8081A/8081B	Heptachlor Epoxide
GC-ECD	EPA 8081A/8081B	Methoxychlor
GC-ECD	EPA 8081A/8081B	Toxaphene
GC-ECD	EPA 8081A/8081B	Chlordane (technical)
GC-ECD	EPA 8082/8082A	PCB-1016
GC-ECD	EPA 8082/8082A	PCB-1221
GC-ECD	EPA 8082/8082A	PCB-1232
GC-ECD	EPA 8082/8082A	PCB-1242
GC-ECD	EPA 8082/8082A	PCB-1248
GC-ECD	EPA 8082/8082A	PCB-1254
GC-ECD	EPA 8082/8082A	PCB-1260
GC-ECD	EPA 8082/8082A	PCB-1262
GC-ECD	EPA 8082/8082A	PCB-1268
GC/MS	EPA 8280A/8280B	2,3,7,8-TeCDD
GC/MS	EPA 8280A/8280B	1,2,3,7,8-PeCDD
GC/MS	EPA 8280A/8280B	1,2,3,4,7,8-HxCDD
GC/MS	EPA 8280A/8280B	1,2,3,6,7,8-HxCDD
GC/MS	EPA 8280A/8280B	1,2,3,7,8,9-HxCDD
GC/MS	EPA 8280A/8280B	1,2,3,4,6,7,8-HpCDD
GC/MS	EPA 8280A/8280B	OCDD
GC/MS	EPA 8280A/8280B	2,3,7,8-TeCDF
GC/MS	EPA 8280A/8280B	1,2,3,7,8-PeCDF
GC/MS	EPA 8280A/8280B	2,3,4,7,8-PeCDF
GC/MS	EPA 8280A/8280B	1,2,3,4,7,8-HxCDF
GC/MS	EPA 8280A/8280B	1,2,3,6,7,8-HxCDF
GC/MS	EPA 8280A/8280B	1,2,3,7,8,9-HxCDF
GC/MS	EPA 8280A/8280B	2,3,4,6,7,8-HxCDF
GC/MS	EPA 8280A/8280B	1,2,3,4,6,7,8-HpCDF
GC/MS	EPA 8280A/8280B	1,2,3,4,7,8,9-HpCDF
GC/MS	EPA 8280A/8280B	OCDF
GC/MS	EPA 8280A/8280B	Total TCDD
GC/MS	EPA 8280A/8280B	Total PeCDD

Non-Potable Water

Technology	Method	Analyte
GC/MS	EPA 8280A/8280B	Total HxCDD
GC/MS	EPA 8280A/8280B	Total HeptaCDD
GC/MS	EPA 8280A/8280B	Total TCDF
GC/MS	EPA 8280A/8280B	Total PeCDF
GC/MS	EPA 8280A/8280B	Total HxCDF
GC/MS	EPA 8280A/8280B	Total HpCDF
GC/HRMS	EPA 8290/8290A/1613B	2,3,7,8-TeCDD
GC/HRMS	EPA 8290/8290A/1613B	1,2,3,7,8-PeCDD
GC/HRMS	EPA 8290/8290A/1613B	1,2,3,4,7,8-HxCDD
GC/HRMS	EPA 8290/8290A/1613B	1,2,3,6,7,8-HxCDD
GC/HRMS	EPA 8290/8290A/1613B	1,2,3,7,8,9-HxCDD
GC/HRMS	EPA 8290/8290A/1613B	1,2,3,4,6,7,8-HpCDD
GC/HRMS	EPA 8290/8290A/1613B	OCDD
GC/HRMS	EPA 8290/8290A/1613B	2,3,7,8-TeCDF
GC/HRMS	EPA 8290/8290A/1613B	1,2,3,7,8-PeCDF
GC/HRMS	EPA 8290/8290A/1613B	2,3,4,7,8-PeCDF
GC/HRMS	EPA 8290/8290A/1613B	1,2,3,4,7,8-HxCDF
GC/HRMS	EPA 8290/8290A/1613B	1,2,3,6,7,8-HxCDF
GC/HRMS	EPA 8290/8290A/1613B	1,2,3,7,8,9-HxCDF
GC/HRMS	EPA 8290/8290A/1613B	2,3,4,6,7,8-HxCDF
GC/HRMS	EPA 8290/8290A/1613B	1,2,3,4,6,7,8-HpCDF
GC/HRMS	EPA 8290/8290A/1613B	1,2,3,4,7,8,9-HpCDF
GC/HRMS	EPA 8290/8290A/1613B	OCDF
GC/HRMS	EPA 8290/8290A/1613B	Total TCDD
GC/HRMS	EPA 8290/8290A/1613B	Total PeCDD
GC/HRMS	EPA 8290/8290A/1613B	Total HxCDD
GC/HRMS	EPA 8290/8290A/1613B	Total HpCDD
GC/HRMS	EPA 8290/8290A/1613B	Total TCDF
GC/HRMS	EPA 8290/8290A/1613B	Total PeCDF
GC/HRMS	EPA 8290/8290A/1613B	Total HxCDF
GC/HRMS	EPA 8290/8290A/1613B	Total HpCDF
HPLC/UV	EPA 8330A/8330B	2-Amino-4,6-dinitrotoluene
HPLC/UV	EPA 8330A/8330B	4-Amino-2,6-dinitrotoluene
HPLC/UV	EPA 8330A/8330B	3,5-Dinitroaniline
HPLC/UV	EPA 8330A/8330B	1,3-Dinitrobenzene
HPLC/UV	EPA 8330A/8330B	2,4-Dinitrotoluene

Non-Potable Water		
Technology	**Method**	**Analyte**
HPLC/UV	EPA 8330A/8330B	2,6-Dinitrotoluene
HPLC/UV	EPA 8330A/8330B	Glycerol trinitrate (Nitroglycerin)
HPLC/UV	EPA 8330A/8330B	Hexahydro-1,3,5-trinitro- 1,3,5-triazine (Hexogen)
HPLC/UV	EPA 8330A/8330B	Methyl-2,4,6- trinitrophenylnitramine
HPLC/UV	EPA 8330A/8330B	Nitrobenzene
HPLC/UV	EPA 8330A/8330B	2-Nitrotoluene (o-Nitrotoluene)
HPLC/UV	EPA 8330A/8330B	3-Nitrotoluene (m-Nitrotoluene)
HPLC/UV	EPA 8330A/8330B	4-Nitrotoluene (p-Nitrotoluene)
HPLC/UV	EPA 8330A/8330B	Octahydro-1,3,5,7- tetranitro1,3,5,7-tetracine (Octogen)
HPLC/UV	EPA 8330A/8330B	Picric acid
HPLC/UV	EPA 8330A/8330B	Pentaerythritol Tetranitrate
HPLC/UV	EPA 8330A/8330B	1,3,5-Trinitrobenzene
HPLC/UV	EPA 8330A/8330B	2,4,6-Trinitrotoluene
HPLC/UV	EPA 8330A/8330B	Hexahydro-1,3-dinitroso-5- nitro-1,3,5,triazine (DNX)
HPLC/UV	EPA 8330A/8330B	Hexahydro-1,3,5-trinitroso- 1,3,5-triazine (TNX)
HPLC/UV	EPA 8330A/8330B	1-Nitroso-3,5-dinitro-1,3,5- triazacyclohexane (MNX)
HPLC/UV	EPA 8330A Modified /WS-LC-0010	Nitroguanidine
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	6:2 Fluorotelomer sulfonate (6:2 FTS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	8:2 Fluorotelomer sulfonate (8:2 FTS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	N-Ethyl perfluorooctanesulfon amidacetic acid (EtFOSAA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	N-Methyl perfluorooctanesulfon amidoacetic acid (MeFOSAA)

Non-Potable Water		
Technology	**Method**	**Analyte**
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorooctanoic acid (PFOA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorooctane Sulfonic Acid (PFOS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorobutyric acid (PFBA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluoropentanoic acid (PFPA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorohexanoic acid (PFHxA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluoroheptanoic acid (PFHpA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorononanoic acid (PFNA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorodecanoic acid (PFDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluoroundecanoic acid (PFUDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorododecanoic acid (PFDoDA)

Non-Potable Water		
Technology	**Method**	**Analyte**
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorotridecanoic acid (PFTriA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorotetradecanoic acid (PDTeA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorobutane Sulfonic Acid (PFBS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorohexane Sulfonic Acid (PFHxS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluoroheptane Sulfonic Acid (PFHpS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorodecane Sulfonic Acid (PFDS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluoroocatane Sulfonamide (FOSA)
GC/HRMS	EPA 1668A/1668C	PCB 1
GC/HRMS	EPA 1668A/1668C	PCB 2
GC/HRMS	EPA 1668A/1668C	PCB 3
GC/HRMS	EPA 1668A/1668C	PCB 4
GC/HRMS	EPA 1668A/1668C	PCB 5
GC/HRMS	EPA 1668A/1668C	PCB 6
GC/HRMS	EPA 1668A/1668C	PCB 7
GC/HRMS	EPA 1668A/1668C	PCB 8
GC/HRMS	EPA 1668A/1668C	PCB 9
GC/HRMS	EPA 1668A/1668C	PCB 10
GC/HRMS	EPA 1668A/1668C	PCB 11
GC/HRMS	EPA 1668A/1668C	PCB 12

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/HRMS	EPA 1668A/1668C	PCB 13
GC/HRMS	EPA 1668A/1668C	PCB 14
GC/HRMS	EPA 1668A/1668C	PCB 15
GC/HRMS	EPA 1668A/1668C	PCB 16
GC/HRMS	EPA 1668A/1668C	PCB 17
GC/HRMS	EPA 1668A/1668C	PCB 18
GC/HRMS	EPA 1668A/1668C	PCB 19
GC/HRMS	EPA 1668A/1668C	PCB 20
GC/HRMS	EPA 1668A/1668C	PCB 21
GC/HRMS	EPA 1668A/1668C	PCB 22
GC/HRMS	EPA 1668A/1668C	PCB 23
GC/HRMS	EPA 1668A/1668C	PCB 24
GC/HRMS	EPA 1668A/1668C	PCB 25
GC/HRMS	EPA 1668A/1668C	PCB 26
GC/HRMS	EPA 1668A/1668C	PCB 27
GC/HRMS	EPA 1668A/1668C	PCB 28
GC/HRMS	EPA 1668A/1668C	PCB 29
GC/HRMS	EPA 1668A/1668C	PCB 30
GC/HRMS	EPA 1668A/1668C	PCB 32
GC/HRMS	EPA 1668A/1668C	PCB 31
GC/HRMS	EPA 1668A/1668C	PCB 33
GC/HRMS	EPA 1668A/1668C	PCB 34
GC/HRMS	EPA 1668A/1668C	PCB 35
GC/HRMS	EPA 1668A/1668C	PCB 36
GC/HRMS	EPA 1668A/1668C	PCB 37
GC/HRMS	EPA 1668A/1668C	PCB 38
GC/HRMS	EPA 1668A/1668C	PCB 39
GC/HRMS	EPA 1668A/1668C	PCB 40
GC/HRMS	EPA 1668A/1668C	PCB 41
GC/HRMS	EPA 1668A/1668C	PCB 42
GC/HRMS	EPA 1668A/1668C	PCB 43
GC/HRMS	EPA 1668A/1668C	PCB 44
GC/HRMS	EPA 1668A/1668C	PCB 45
GC/HRMS	EPA 1668A/1668C	PCB 46
GC/HRMS	EPA 1668A/1668C	PCB 47
GC/HRMS	EPA 1668A/1668C	PCB 48

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/HRMS	EPA 1668A/1668C	PCB 49
GC/HRMS	EPA 1668A/1668C	PCB 50
GC/HRMS	EPA 1668A/1668C	PCB 51
GC/HRMS	EPA 1668A/1668C	PCB 52
GC/HRMS	EPA 1668A/1668C	PCB 53
GC/HRMS	EPA 1668A/1668C	PCB 54
GC/HRMS	EPA 1668A/1668C	PCB 55
GC/HRMS	EPA 1668A/1668C	PCB 56
GC/HRMS	EPA 1668A/1668C	PCB 57
GC/HRMS	EPA 1668A/1668C	PCB 58
GC/HRMS	EPA 1668A/1668C	PCB 59
GC/HRMS	EPA 1668A/1668C	PCB 60
GC/HRMS	EPA 1668A/1668C	PCB 61
GC/HRMS	EPA 1668A/1668C	PCB 62
GC/HRMS	EPA 1668A/1668C	PCB 63
GC/HRMS	EPA 1668A/1668C	PCB 64
GC/HRMS	EPA 1668A/1668C	PCB 65
GC/HRMS	EPA 1668A/1668C	PCB 66
GC/HRMS	EPA 1668A/1668C	PCB 67
GC/HRMS	EPA 1668A/1668C	PCB 68
GC/HRMS	EPA 1668A/1668C	PCB 69
GC/HRMS	EPA 1668A/1668C	PCB 70
GC/HRMS	EPA 1668A/1668C	PCB 71
GC/HRMS	EPA 1668A/1668C	PCB 72
GC/HRMS	EPA 1668A/1668C	PCB 73
GC/HRMS	EPA 1668A/1668C	PCB 74
GC/HRMS	EPA 1668A/1668C	PCB 75
GC/HRMS	EPA 1668A/1668C	PCB 76
GC/HRMS	EPA 1668A/1668C	PCB 77
GC/HRMS	EPA 1668A/1668C	PCB 78
GC/HRMS	EPA 1668A/1668C	PCB 79
GC/HRMS	EPA 1668A/1668C	PCB 80
GC/HRMS	EPA 1668A/1668C	PCB 81
GC/HRMS	EPA 1668A/1668C	PCB 82
GC/HRMS	EPA 1668A/1668C	PCB 83
GC/HRMS	EPA 1668A/1668C	PCB 84

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/HRMS	EPA 1668A/1668C	PCB 85
GC/HRMS	EPA 1668A/1668C	PCB 86
GC/HRMS	EPA 1668A/1668C	PCB 87
GC/HRMS	EPA 1668A/1668C	PCB 88
GC/HRMS	EPA 1668A/1668C	PCB 89
GC/HRMS	EPA 1668A/1668C	PCB 90
GC/HRMS	EPA 1668A/1668C	PCB 91
GC/HRMS	EPA 1668A/1668C	PCB 92
GC/HRMS	EPA 1668A/1668C	PCB 93
GC/HRMS	EPA 1668A/1668C	PCB 94
GC/HRMS	EPA 1668A/1668C	PCB 95
GC/HRMS	EPA 1668A/1668C	PCB 96
GC/HRMS	EPA 1668A/1668C	PCB 97
GC/HRMS	EPA 1668A/1668C	PCB 98
GC/HRMS	EPA 1668A/1668C	PCB 99
GC/HRMS	EPA 1668A/1668C	PCB 100
GC/HRMS	EPA 1668A/1668C	PCB 101
GC/HRMS	EPA 1668A/1668C	PCB 102
GC/HRMS	EPA 1668A/1668C	PCB 103
GC/HRMS	EPA 1668A/1668C	PCB 104
GC/HRMS	EPA 1668A/1668C	PCB 105
GC/HRMS	EPA 1668A/1668C	PCB 106
GC/HRMS	EPA 1668A/1668C	PCB 107
GC/HRMS	EPA 1668A/1668C	PCB 108
GC/HRMS	EPA 1668A/1668C	PCB 109
GC/HRMS	EPA 1668A/1668C	PCB 110
GC/HRMS	EPA 1668A/1668C	PCB 111
GC/HRMS	EPA 1668A/1668C	PCB 112
GC/HRMS	EPA 1668A/1668C	PCB 113
GC/HRMS	EPA 1668A/1668C	PCB 114
GC/HRMS	EPA 1668A/1668C	PCB 115
GC/HRMS	EPA 1668A/1668C	PCB 116
GC/HRMS	EPA 1668A/1668C	PCB 117
GC/HRMS	EPA 1668A/1668C	PCB 118
GC/HRMS	EPA 1668A/1668C	PCB 119
GC/HRMS	EPA 1668A/1668C	PCB 120

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/HRMS	EPA 1668A/1668C	PCB 121
GC/HRMS	EPA 1668A/1668C	PCB 122
GC/HRMS	EPA 1668A/1668C	PCB 123
GC/HRMS	EPA 1668A/1668C	PCB 124
GC/HRMS	EPA 1668A/1668C	PCB 125
GC/HRMS	EPA 1668A/1668C	PCB 126
GC/HRMS	EPA 1668A/1668C	PCB 127
GC/HRMS	EPA 1668A/1668C	PCB 128
GC/HRMS	EPA 1668A/1668C	PCB 129
GC/HRMS	EPA 1668A/1668C	PCB 130
GC/HRMS	EPA 1668A/1668C	PCB 131
GC/HRMS	EPA 1668A/1668C	PCB 132
GC/HRMS	EPA 1668A/1668C	PCB 133
GC/HRMS	EPA 1668A/1668C	PCB 134
GC/HRMS	EPA 1668A/1668C	PCB 135
GC/HRMS	EPA 1668A/1668C	PCB 136
GC/HRMS	EPA 1668A/1668C	PCB 137
GC/HRMS	EPA 1668A/1668C	PCB 138
GC/HRMS	EPA 1668A/1668C	PCB 139
GC/HRMS	EPA 1668A/1668C	PCB 140
GC/HRMS	EPA 1668A/1668C	PCB 141
GC/HRMS	EPA 1668A/1668C	PCB 142
GC/HRMS	EPA 1668A/1668C	PCB 143
GC/HRMS	EPA 1668A/1668C	PCB 144
GC/HRMS	EPA 1668A/1668C	PCB 145
GC/HRMS	EPA 1668A/1668C	PCB 146
GC/HRMS	EPA 1668A/1668C	PCB 147
GC/HRMS	EPA 1668A/1668C	PCB 148
GC/HRMS	EPA 1668A/1668C	PCB 149
GC/HRMS	EPA 1668A/1668C	PCB 150
GC/HRMS	EPA 1668A/1668C	PCB 151
GC/HRMS	EPA 1668A/1668C	PCB 152
GC/HRMS	EPA 1668A/1668C	PCB 153
GC/HRMS	EPA 1668A/1668C	PCB 154
GC/HRMS	EPA 1668A/1668C	PCB 155
GC/HRMS	EPA 1668A/1668C	PCB 156

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Non-Potable Water		
Technology	**Method**	**Analyte**
GC/HRMS	EPA 1668A/1668C	PCB 157
GC/HRMS	EPA 1668A/1668C	PCB 158
GC/HRMS	EPA 1668A/1668C	PCB 159
GC/HRMS	EPA 1668A/1668C	PCB 160
GC/HRMS	EPA 1668A/1668C	PCB 161
GC/HRMS	EPA 1668A/1668C	PCB 162
GC/HRMS	EPA 1668A/1668C	PCB 163
GC/HRMS	EPA 1668A/1668C	PCB 164
GC/HRMS	EPA 1668A/1668C	PCB 165
GC/HRMS	EPA 1668A/1668C	PCB 166
GC/HRMS	EPA 1668A/1668C	PCB 167
GC/HRMS	EPA 1668A/1668C	PCB 168
GC/HRMS	EPA 1668A/1668C	PCB 169
GC/HRMS	EPA 1668A/1668C	PCB 170
GC/HRMS	EPA 1668A/1668C	PCB 171
GC/HRMS	EPA 1668A/1668C	PCB 172
GC/HRMS	EPA 1668A/1668C	PCB 173
GC/HRMS	EPA 1668A/1668C	PCB 174
GC/HRMS	EPA 1668A/1668C	PCB 175
GC/HRMS	EPA 1668A/1668C	PCB 176
GC/HRMS	EPA 1668A/1668C	PCB 177
GC/HRMS	EPA 1668A/1668C	PCB 178
GC/HRMS	EPA 1668A/1668C	PCB 179
GC/HRMS	EPA 1668A/1668C	PCB 180
GC/HRMS	EPA 1668A/1668C	PCB 181
GC/HRMS	EPA 1668A/1668C	PCB 182
GC/HRMS	EPA 1668A/1668C	PCB 183
GC/HRMS	EPA 1668A/1668C	PCB 184
GC/HRMS	EPA 1668A/1668C	PCB 185
GC/HRMS	EPA 1668A/1668C	PCB 186
GC/HRMS	EPA 1668A/1668C	PCB 187
GC/HRMS	EPA 1668A/1668C	PCB 188
GC/HRMS	EPA 1668A/1668C	PCB 189
GC/HRMS	EPA 1668A/1668C	PCB 190
GC/HRMS	EPA 1668A/1668C	PCB 191
GC/HRMS	EPA 1668A/1668C	PCB 192

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/HRMS	EPA 1668A/1668C	PCB 193
GC/HRMS	EPA 1668A/1668C	PCB 194
GC/HRMS	EPA 1668A/1668C	PCB 195
GC/HRMS	EPA 1668A/1668C	PCB 196
GC/HRMS	EPA 1668A/1668C	PCB 197
GC/HRMS	EPA 1668A/1668C	PCB 198
GC/HRMS	EPA 1668A/1668C	PCB 199
GC/HRMS	EPA 1668A/1668C	PCB 200
GC/HRMS	EPA 1668A/1668C	PCB 201
GC/HRMS	EPA 1668A/1668C	PCB 202
GC/HRMS	EPA 1668A/1668C	PCB 203
GC/HRMS	EPA 1668A/1668C	PCB 204
GC/HRMS	EPA 1668A/1668C	PCB 205
GC/HRMS	EPA 1668A/1668C	PCB 206
GC/HRMS	EPA 1668A/1668C	PCB 207
GC/HRMS	EPA 1668A/1668C	PCB 208
GC/HRMS	EPA 1668A/1668C	PCB 209
Preparation	**Method**	**Type**
Acid Digestion (Aqueous)	EPA 3005A/3010A	Inorganics
Separatory Funnel Liquid-Liquid Extraction	EPA 3510C	Semivolatile and Non-Volatile Organics
Solid Phase Extraction	EPA 3535A	Semivolatile and Non-Volatile Organics
Purge and Trap	EPA 5030B/5030C	Volatile Organic Compounds
Florisil Cleanup	EPA 3620B/3620C	Cleanup of pesticide residues and other chlorinated hydrocarbons
Sulfur Cleanup	EPA 3660A	Sulfur Cleanup
Sulfuric Acid Cleanup	EPA 3665A	Sulfuric Acid Cleanup for PCBs
Silica Gel Cleanup	EPA 3630C	Column Cleanup

Drinking Water		
Technology	**Method**	**Analyte**
LC/MS/MS	EPA 537	Perfluorobutane Sulfonic Acid (PFBS)
LC/MS/MS	EPA 537	Perfluoroheptanoic acid (PFHpA)
LC/MS/MS	EPA 537	Perfluorohexane Sulfonic Acid (PFHxS)
LC/MS/MS	EPA 537	Perfluorononanoic acid (PFNA)

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LC/MS/MS	EPA 537	Perfluorooctanoic acid (PFOA)
LC/MS/MS	EPA 537	Perfluorooctane Sulfonic Acid(PFOS)
Preparation	**Method**	**Type**
Solid Phase Extraction	EPA 537	Perfluoro compounds in Drinking Water

Solid and Chemical Materials

Technology	Method	Analyte
ICP-AES	EPA 6010B/6010C	Aluminum
ICP-AES	EPA 6010B/6010C	Antimony
ICP-AES	EPA 6010B/6010C	Arsenic
ICP-AES	EPA 6010B/6010C	Barium
ICP-AES	EPA 6010B/6010C	Beryllium
ICP-AES	EPA 6010B/6010C	Boron
ICP-AES	EPA 6010B/6010C	Cadmium
ICP-AES	EPA 6010B/6010C	Calcium
ICP-AES	EPA 6010B/6010C	Chromium (Total)
ICP-AES	EPA 6010B/6010C	Cobalt
ICP-AES	EPA 6010B/6010C	Copper
ICP-AES	EPA 6010B/6010C	Iron
ICP-AES	EPA 6010B/6010C	Lead
ICP-AES	EPA 6010B/6010C	Magnesium
ICP-AES	EPA 6010B/6010C	Manganese
ICP-AES	EPA 6010B/6010C	Molybdenum
ICP-AES	EPA 6010B/6010C	Nickel
ICP-AES	EPA 6010B/6010C	Potassium
ICP-AES	EPA 6010B/6010C	Selenium
ICP-AES	EPA 6010B/6010C	Silver
ICP-AES	EPA 6010B/6010C	Sodium
ICP-AES	EPA 6010B/6010C	Thallium
ICP-AES	EPA 6010B/6010C	Tin
ICP-AES	EPA 6010B/6010C	Titanium
ICP-AES	EPA 6010B/6010C	Vanadium
ICP-AES	EPA 6010B/6010C	Zinc
ICP-MS	EPA 6020/6020A	Aluminum
ICP-MS	EPA 6020/6020A	Antimony
ICP-MS	EPA 6020/6020A	Arsenic
ICP-MS	EPA 6020/6020A	Barium

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
ICP-MS	EPA 6020/6020A	Beryllium
ICP-MS	EPA 6020/6020A	Cadmium
ICP-MS	EPA 6020/6020A	Calcium
ICP-MS	EPA 6020/6020A	Chromium (Total)
ICP-MS	EPA 6020/6020A	Cobalt
ICP-MS	EPA 6020/6020A	Copper
ICP-MS	EPA 6020/6020A	Iron
ICP-MS	EPA 6020/6020A	Lead
ICP-MS	EPA 6020/6020A	Magnesium
ICP-MS	EPA 6020/6020A	Manganese
ICP-MS	EPA 6020/6020A	Molybdenum
ICP-MS	EPA 6020/6020A	Nickel
ICP-MS	EPA 6020/6020A	Phosphorus
ICP-MS	EPA 6020/6020A	Potassium
ICP-MS	EPA 6020/6020A	Selenium
ICP-MS	EPA 6020/6020A	Silver
ICP-MS	EPA 6020/6020A	Sodium
ICP-MS	EPA 6020/6020A	Strontium
ICP-MS	EPA 6020/6020A	Thallium
ICP-MS	EPA 6020/6020A	Tin
ICP-MS	EPA 6020/6020A	Titanium
ICP-MS	EPA 6020/6020A	Uranium
ICP-MS	EPA 6020/6020A	Vanadium
ICP-MS	EPA 6020/6020A	Zinc
CVAAS	EPA 7471A/7471B	Mercury
Colorimetric	EPA 353.2	Nitrate
Colorimetric	EPA 353.2	Nitrate-nitrite
Colorimetric	EPA 353.2	Nitrite
Colorimetric/Hydrolysis	EPA 353.2 Modified /WS-WC-0050	Nitrocellulose
LC/MS/MS	EPA 6850	Perchlorate
Probe	EPA 9045C/9045D	pH
Ion Chromatography	EPA 9056A/300.0	Bromide
Ion Chromatography	EPA 9056A/300.0	Chloride
Ion Chromatography	EPA 9056A/300.0	Fluoride
Ion Chromatography	EPA 9056A/300.0	Sulfate
Ion Chromatography	EPA 9056A/300.0	Nitrate

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
Ion Chromatography	EPA 9056A/300.0	Nitrite
Gravimetric	ASTM D2216	%Moisture
GC/MS	EPA 8260B/8260C	1,1,1,2-Tetrachloroethane
GC/MS	EPA 8260B/8260C	1,1,1-Trichloroethane
GC/MS	EPA 8260B/8260C	1,1,2,2-Tetrachloroethane
GC/MS	EPA 8260B/8260C	1,1,2-Trichloroethane
GC/MS	EPA 8260B/8260C	1,1,2-Trichloro-1,2,2-trifluoroethane
GC/MS	EPA 8260B/8260C	1,1-Dichloroethane
GC/MS	EPA 8260B/8260C	1,1-Dichloroethene
GC/MS	EPA 8260B/8260C	1,1-Dichloropropene
GC/MS	EPA 8260B/8260C	1,2,3-Trichlorobenzene
GC/MS	EPA 8260B/8260C	1,2,3-Trichloropropane
GC/MS	EPA 8260B/8260C	1,2,4-Trichlorobenzene
GC/MS	EPA 8260B/8260C	1,2,4-Trimethylbenzene
GC/MS	EPA 8260B/8260C	1,2-Dibromo-3-chloropropane
GC/MS	EPA 8260B/8260C	1,2-Dibromoethane
GC/MS	EPA 8260B/8260C	1,2-Dichlorobenzene
GC/MS	EPA 8260B/8260C	1,2-Dichloroethane
GC/MS	EPA 8260B/8260C	1,2-Dichloropropane
GC/MS	EPA 8260B/8260C	1,3,5-Trimethylbenzene
GC/MS	EPA 8260B/8260C	1,3-Dichlorobenzene
GC/MS	EPA 8260B/8260C	1,3-Dichloropropane
GC/MS	EPA 8260B/8260C	1,4-Dichlorobenzene
GC/MS	EPA 8260B/8260C	1-Chlorohexane
GC/MS	EPA 8260B/8260C	2,2-Dichloropropane
GC/MS	EPA 8260B/8260C	2-Butanone (MEK)
GC/MS	EPA 8260B/8260C	2-Chlorotoluene
GC/MS	EPA 8260B/8260C	2-Hexanone (MBK)
GC/MS	EPA 8260B/8260C	2-Methyl-2-propanol (tert- Butyl Alcohol, TBA)
GC/MS	EPA 8260B/8260C	4-Chlorotoluene
GC/MS	EPA 8260B/8260C	4-Isopropyltoluene
GC/MS	EPA 8260B/8260C	4-Methyl-2-pentanone (MIBK)
GC/MS	EPA 8260B/8260C	Acetone
GC/MS	EPA 8260B/8260C	Allyl Chloride
GC/MS	EPA 8260B/8260C	Benzene
GC/MS	EPA 8260B/8260C	Bromobenzene

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/8260C	Bromochloromethane
GC/MS	EPA 8260B/8260C	Bromodichloromethane
GC/MS	EPA 8260B/8260C	Bromoform
GC/MS	EPA 8260B/8260C	Bromomethane
GC/MS	EPA 8260B/8260C	Carbon Disulfide
GC/MS	EPA 8260B/8260C	Carbon Tetrachloride
GC/MS	EPA 8260B/8260C	Chlorobenzene
GC/MS	EPA 8260B/8260C	Chloroethane
GC/MS	EPA 8260B/8260C	Chloroform
GC/MS	EPA 8260B/8260C	Chloromethane
GC/MS	EPA 8260B/8260C	cis-1,2-Dichloroethene
GC/MS	EPA 8260B/8260C	cis-1,3-Dichloropropene
GC/MS	EPA 8260B/8260C	Cyclohexane
GC/MS	EPA 8260B/8260C	Dibromochloromethane
GC/MS	EPA 8260B/8260C	Dibromomethane
GC/MS	EPA 8260B/8260C	Dichlorodifluoromethane
GC/MS	EPA 8260B/8260C	Diisopropyl Ether (DIPE)
GC/MS	EPA 8260B/8260C	Ethylbenzene
GC/MS	EPA 8260B/8260C	Ethylmethacrylate
GC/MS	EPA 8260B/8260C	Ethyl tert-butyl Ether (ETBE)
GC/MS	EPA 8260B/8260C	Hexachlorobutadiene
GC/MS	EPA 8260B/8260C	Hexane
GC/MS	EPA 8260B/8260C	Iodomethane
GC/MS	EPA 8260B/8260C	Isobutanol (2-Methyl-1-propanol)
GC/MS	EPA 8260B/8260C	Isopropylbenzene
GC/MS	EPA 8260B/8260C	m & p Xylene
GC/MS	EPA 8260B/8260C	Methyl tert-butyl Ether (MTBE)
GC/MS	EPA 8260B/8260C	Methylene Chloride
GC/MS	EPA 8260B/8260C	Naphthalene
GC/MS	EPA 8260B/8260C	n-Butylbenzene
GC/MS	EPA 8260B/8260C	n-Propylbenzene
GC/MS	EPA 8260B/8260C	o-Xylene
GC/MS	EPA 8260B/8260C	sec-Butylbenzene
GC/MS	EPA 8260B/8260C	Styrene
GC/MS	EPA 8260B/8260C	t-Amyl methyl Ether (TAME)
GC/MS	EPA 8260B/8260C	t-1,4-Dichloro-2-Butene

ANSI-ASQ National Accreditation Board

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/8260C	tert-Butylbenzene
GC/MS	EPA 8260B/8260C	Tetrachloroethene
GC/MS	EPA 8260B/8260C	Toluene
GC/MS	EPA 8260B/8260C	trans-1,2-Dichloroethene
GC/MS	EPA 8260B/8260C	trans-1,3-Dichloropropene
GC/MS	EPA 8260B/8260C	Trichloroethene
GC/MS	EPA 8260B/8260C	Trichlorofluoromethane
GC/MS	EPA 8260B/8260C	Vinyl Acetate
GC/MS	EPA 8260B/8260C	Vinyl Chloride
GC/MS	EPA 8260B/8260C	Xylenes, Total
GC/MS	EPA 8260B/AK101MS	Gasoline Range Organics (GRO)
GC/MS	EPA 8270C/8270D	1,2,4,5-Tetrachlorobenzene
GC/MS	EPA 8270C/8270D	1,2,4-Trichlorobenzene
GC/MS	EPA 8270C/8270D	1,2-Dichlorobenzene
GC/MS	EPA 8270C/8270D	1,2-Diphenylhydrazine (as Azobenzene)
GC/MS	EPA 8270C/8270D	1,3-Dichlorobenzene
GC/MS	EPA 8270C/8270D	1,3-Dinitrobenzene
GC/MS	EPA 8270C/8270D	1,4-Dichlorobenzene
GC/MS	EPA 8270C/8270D	1-Methylnaphthalene
GC/MS	EPA 8270C/8270D	2,3,4,6-Tetrachlorophenol
GC/MS	EPA 8270C/8270D	2,4,5-Trichlorophenol
GC/MS	EPA 8270C/8270D	2,4,6-Trichlorophenol
GC/MS	EPA 8270C/8270D	2,4-Dichlorophenol
GC/MS	EPA 8270C/8270D	2,4-Dimethylphenol
GC/MS	EPA 8270C/8270D	2,4-Dinitrophenol
GC/MS	EPA 8270C/8270D	2,4-Dinitrotoluene
GC/MS	EPA 8270C/8270D	2,6-Dichlorophenol
GC/MS	EPA 8270C/8270D	2,6-Dinitrotoluene
GC/MS	EPA 8270C/8270D	2-Chloronaphthalene
GC/MS	EPA 8270C/8270D	2-Chlorophenol
GC/MS	EPA 8270C/8270D	2-Methylnaphthalene
GC/MS	EPA 8270C/8270D	2-Methylphenol
GC/MS	EPA 8270C/8270D	2-Nitroaniline
GC/MS	EPA 8270C/8270D	2-Nitrophenol
GC/MS	EPA 8270C/8270D	3&4-Methylphenol
GC/MS	EPA 8270C/8270D	3,3'-Dichlorobenzidine

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/8270D	3-Nitroaniline
GC/MS	EPA 8270C/8270D	4,6-Dinitro-2-methylphenol
GC/MS	EPA 8270C/8270D	4-Bromophenyl phenyl ether
GC/MS	EPA 8270C/8270D	4-Chloro-3-methylphenol
GC/MS	EPA 8270C/8270D	4-Chloroaniline
GC/MS	EPA 8270C/8270D	4-Chlorophenyl phenyl ether
GC/MS	EPA 8270C/8270D	4-Nitroaniline
GC/MS	EPA 8270C/8270D	4-Nitrophenol
GC/MS	EPA 8270C/8270D	Acenaphthene
GC/MS	EPA 8270C/8270D	Acenaphthylene
GC/MS	EPA 8270C/8270D	Aniline
GC/MS	EPA 8270C/8270D	Anthracene
GC/MS	EPA 8270C/8270D	Benzo(a)anthracene
GC/MS	EPA 8270C/8270D	Benzo(a)pyrene
GC/MS	EPA 8270C/8270D	Benzo(b)fluoranthene
GC/MS	EPA 8270C/8270D	Benzo(g,h,i)perylene
GC/MS	EPA 8270C/8270D	Benzo(k)fluoranthene
GC/MS	EPA 8270C/8270D	Benzoic Acid
GC/MS	EPA 8270C/8270D	Benzyl Alcohol
GC/MS	EPA 8270C/8270D	Benzyl butyl Phthalate
GC/MS	EPA 8270C/8270D	Biphenyl
GC/MS	EPA 8270C/8270D	Bis(2-chloroethoxy) Methane
GC/MS	EPA 8270C/8270D	Bis(2-chloroethyl) Ether
GC/MS	EPA 8270C/8270D	Bis(2-chloroisopropyl) Ether
GC/MS	EPA 8270C/8270D	Carbazole
GC/MS	EPA 8270C/8270D	Chrysene
GC/MS	EPA 8270C/8270D	Bis (2-ethylhexyl) Phthalate
GC/MS	EPA 8270C/8270D	Dibenz(a,h)anthracene
GC/MS	EPA 8270C/8270D	Dibenzofuran
GC/MS	EPA 8270C/8270D	Diethyl Phthalate
GC/MS	EPA 8270C/8270D	Dimethyl Phthalate
GC/MS	EPA 8270C/8270D	Di-n-butyl Phthalate
GC/MS	EPA 8270C/8270D	Di-n-octyl Phthalate
GC/MS	EPA 8270C/8270D	Fluoranthene
GC/MS	EPA 8270C/8270D	Fluorene
GC/MS	EPA 8270C/8270D	Hexachlorobenzene

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C/8270D	Hexachlorobutadiene
GC/MS	EPA 8270C/8270D	Hexachlorocyclopentadiene
GC/MS	EPA 8270C/8270D	Hexachloroethane
GC/MS	EPA 8270C/8270D	Indeno(1,2,3-c,d) Pyrene
GC/MS	EPA 8270C/8270D	Isophorone
GC/MS	EPA 8270C/8270D	Naphthalene
GC/MS	EPA 8270C/8270D	Nitrobenzene
GC/MS	EPA 8270C/8270D	n-Nitrosodimethylamine
GC/MS	EPA 8270C/8270D	n-Nitrosodi-n-propylamine
GC/MS	EPA 8270C/8270D	n-Nitrosodiphenylamine
GC/MS	EPA 8270C/8270D	Pentachlorophenol
GC/MS	EPA 8270C/8270D	Phenanthrene
GC/MS	EPA 8270C/8270D	Phenol
GC/MS	EPA 8270C/8270D	Pyrene
GC/MS	EPA 8270C/8270D	Pyridine
GC/MS SIM	EPA 8260C-SIM	1,1,2-Trichloroethane
GC/MS SIM	EPA 8260C-SIM	1,1,2,2-Tetrachloroethane
GC/MS SIM	EPA 8260C-SIM	1,2,3-Trichloropropane
GC/MS SIM	EPA 8260C-SIM	1,2-Dibromoethane
GC/MS SIM	EPA 8260C-SIM	1,2-Dichloroethane
GC/MS SIM	EPA 8260C-SIM	1,3-Butadiene
GC/MS SIM	EPA 8260C-SIM	1,4-Dichlorobenzene
GC/MS SIM	EPA 8260C-SIM	Benzene
GC/MS SIM	EPA 8260C-SIM	Bromodichloromethane
GC/MS SIM	EPA 8260C-SIM	Bromoform
GC/MS SIM	EPA 8260C-SIM	Bromomethane
GC/MS SIM	EPA 8260C-SIM	Chloroform
GC/MS SIM	EPA 8260C-SIM	Dibromochloromethane
GC/MS SIM	EPA 8260C-SIM	Dibromomethane
GC/MS SIM	EPA 8260C-SIM	Hexachlorobutadiene
GC/MS SIM	EPA 8260C-SIM	Naphthalene
GC/MS SIM	EPA 8260C-SIM	Tetrachloroethene
GC/MS SIM	EPA 8260C-SIM	Trichloroethene
GC/MS SIM	EPA 8260C-SIM	Vinyl Chloride
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	1-Methylnaphthalene

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	2-Methylnaphthalene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Acenaphthene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Acenaphthylene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Anthracene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Benzo(a)anthracene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Benzo(a)pyrene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Benzo(b)fluoranthene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Benzo(g,h,i)perylene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Benzo(k)fluoranthene
GC/MS SIM	EPA 8270D-SIM	Bis(2-chloroethyl) Ether
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Chrysene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Dibenz(a,h)anthracene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Fluoranthene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Fluorene
GC/MS SIM	EPA 8270D-SIM	Hexachlorobenzene
GC/MS SIM	EPA 8270D-SIM	Hexachlorocyclopentadiene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Indeno(1,2,3-c,d) Pyrene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Naphthalene
GC/MS SIM	EPA 8270D-SIM	n-Nitrosodi-n-propylamine
GC/MS SIM	EPA 8270D-SIM	Pentachlorophenol
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Phenanthrene
GC/MS SIM	EPA 8270C-SIM EPA 8270D-SIM	Pyrene
GC/MS SIM	EPA 521 Modified / WS-MS-0012	N-Nitrosodimethyl amine (NDMA)

ANSI-ASQ National Accreditation Board

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC-FID	EPA 8015B/8015C/8015D AK102	Diesel Range Organics (DRO)
GC-FID	AK103	Residual Range Organics
GC-FID	EPA 8015B/8015C/8015D	Motor Oil Range Organics (MRO)
GC-ECD	EPA 8081A/8081B	Aldrin
GC-ECD	EPA 8081A/8081B	a-BHC
GC-ECD	EPA 8081A/8081B	b-BHC
GC-ECD	EPA 8081A/8081B	d-BHC
GC-ECD	EPA 8081A/8081B	g-BHC (Lindane)
GC-ECD	EPA 8081A/8081B	a-Chlordane
GC-ECD	EPA 8081A/8081B	g-Chlordane
GC-ECD	EPA 8081A/8081B	4,4'-DDD
GC-ECD	EPA 8081A/8081B	4,4'-DDE
GC-ECD	EPA 8081A/8081B	4,4'-DDT
GC-ECD	EPA 8081A/8081B	Dieldrin
GC-ECD	EPA 8081A/8081B	Endosulfan I
GC-ECD	EPA 8081A/8081B	Endosulfan II
GC-ECD	EPA 8081A/8081B	Endosulfan sulfate
GC-ECD	EPA 8081A/8081B	Endrin
GC-ECD	EPA 8081A/8081B	Endrin Aldehyde
GC-ECD	EPA 8081A/8081B	Endrin Ketone
GC-ECD	EPA 8081A/8081B	Heptachlor
GC-ECD	EPA 8081A/8081B	Heptachlor Epoxide
GC-ECD	EPA 8081A/8081B	Methoxychlor
GC-ECD	EPA 8081A/8081B	Toxaphene
GC-ECD	EPA 8081A/8081B	Chlordane (technical)
GC-ECD	EPA 8082/8082A	PCB-1016
GC-ECD	EPA 8082/8082A	PCB-1221
GC-ECD	EPA 8082/8082A	PCB-1232
GC-ECD	EPA 8082/8082A	PCB-1242
GC-ECD	EPA 8082/8082A	PCB-1248
GC-ECD	EPA 8082/8082A	PCB-1254
GC-ECD	EPA 8082/8082A	PCB-1260
GC-ECD	EPA 8082/8082A	PCB-1262
GC-ECD	EPA 8082/8082A	PCB-1268
GC/MS	EPA 8280A/8280B	2,3,7,8-TeCDD
GC/MS	EPA 8280A/8280B	1,2,3,7,8-PeCDD

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8280A/8280B	1,2,3,4,7,8-HxCDD
GC/MS	EPA 8280A/8280B	1,2,3,6,7,8-HxCDD
GC/MS	EPA 8280A/8280B	1,2,3,7,8,9-HxCDD
GC/MS	EPA 8280A/8280B	1,2,3,4,6,7,8-HpCDD
GC/MS	EPA 8280A/8280B	OCDD
GC/MS	EPA 8280A/8280B	2,3,7,8-TeCDF
GC/MS	EPA 8280A/8280B	1,2,3,7,8-PeCDF
GC/MS	EPA 8280A/8280B	2,3,4,7,8-PeCDF
GC/MS	EPA 8280A/8280B	1,2,3,4,7,8-HxCDF
GC/MS	EPA 8280A/8280B	1,2,3,6,7,8-HxCDF
GC/MS	EPA 8280A/8280B	1,2,3,7,8,9-HxCDF
GC/MS	EPA 8280A/8280B	2,3,4,6,7,8-HxCDF
GC/MS	EPA 8280A/8280B	1,2,3,4,6,7,8-HpCDF
GC/MS	EPA 8280A/8280B	1,2,3,4,7,8,9-HpCDF
GC/MS	EPA 8280A/8280B	OCDF
GC/MS	EPA 8280A/8280B	Total TCDD
GC/MS	EPA 8280A/8280B	Total PeCDD
GC/MS	EPA 8280A/8280B	Total HxCDD
GC/MS	EPA 8280A/8280B	Total HeptaCDD
GC/MS	EPA 8280A/8280B	Total TCDF
GC/MS	EPA 8280A/8280B	Total PeCDF
GC/MS	EPA 8280A/8280B	Total HxCDF
GC/MS	EPA 8280A/8280B	Total HpCDF
GC/HRMS	EPA 8290/ 8290A/1613B	2,3,7,8-TeCDD
GC/HRMS	EPA 8290/ 8290A/1613B	1,2,3,7,8-PeCDD
GC/HRMS	EPA 8290/ 8290A/1613B	1,2,3,4,7,8-HxCDD
GC/HRMS	EPA 8290/ 8290A/1613B	1,2,3,6,7,8-HxCDD
GC/HRMS	EPA 8290/ 8290A/1613B	1,2,3,7,8,9-HxCDD
GC/HRMS	EPA 8290/ 8290A/1613B	1,2,3,4,6,7,8-HpCDD
GC/HRMS	EPA 8290/ 8290A/1613B	OCDD
GC/HRMS	EPA 8290/ 8290A/1613B	2,3,7,8-TeCDF
GC/HRMS	EPA 8290/ 8290A/1613B	1,2,3,7,8-PeCDF
GC/HRMS	EPA 8290/ 8290A/1613B	2,3,4,7,8-PeCDF
GC/HRMS	EPA 8290/ 8290A/1613B	1,2,3,4,7,8-HxCDF
GC/HRMS	EPA 8290/ 8290A/1613B	1,2,3,6,7,8-HxCDF
GC/HRMS	EPA 8290/ 8290A/1613B	1,2,3,7,8,9-HxCDF

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/HRMS	EPA 8290/ 8290A/1613B	2,3,4,6,7,8-HxCDF
GC/HRMS	EPA 8290/ 8290A/1613B	1,2,3,4,6,7,8-HpCDF
GC/HRMS	EPA 8290/ 8290A/1613B	1,2,3,4,7,8,9-HpCDF
GC/HRMS	EPA 8290/ 8290A/1613B	OCDF
GC/HRMS	EPA 8290/ 8290A/1613B	Total TCDD
GC/HRMS	EPA 8290/ 8290A/1613B	Total PeCDD
GC/HRMS	EPA 8290/ 8290A/1613B	Total HxCDD
GC/HRMS	EPA 8290/ 8290A/1613B	Total HpCDD
GC/HRMS	EPA 8290/ 8290A/1613B	Total TCDF
GC/HRMS	EPA 8290/ 8290A/1613B	Total PeCDF
GC/HRMS	EPA 8290/ 8290A/1613B	Total HxCDF
GC/HRMS	EPA 8290/ 8290A/1613B	Total HpCDF
HPLC/UV	EPA 8330A/8330B	2-Amino-4,6-dinitrotoluene
HPLC/UV	EPA 8330A/8330B	4-Amino-2,6-dinitrotoluene
HPLC/UV	EPA 8330A/8330B	3,5-Dinitroaniline
HPLC/UV	EPA 8330A/8330B	1,3-Dinitrobenzene
HPLC/UV	EPA 8330A/8330B	2,4-Dinitrotoluene
HPLC/UV	EPA 8330A/8330B	2,6-Dinitrotoluene
HPLC/UV	EPA 8330A/8330B	Glycerol trinitrate (Nitroglycerin)
HPLC/UV	EPA 8330A/8330B	Hexahydro-1,3,5-trinitro- 1,3,5-triazine (Hexogen)
HPLC/UV	EPA 8330A/8330B	Methyl-2,4,6- trinitrophenylnitramine
HPLC/UV	EPA 8330A/8330B	Nitrobenzene
HPLC/UV	EPA 8330A/8330B	2-Nitrotoluene (o-Nitrotoluene)
HPLC/UV	EPA 8330A/8330B	3-Nitrotoluene (m-Nitrotoluene)
HPLC/UV	EPA 8330A/8330B	4-Nitrotoluene (p-Nitrotoluene)
HPLC/UV	EPA 8330A/8330B	Octahydro-1,3,5,7- tetranitro1,3,5,7-tetracine (Octogen)
HPLC/UV	EPA 8330A/8330B	Picric acid
HPLC/UV	EPA 8330A/8330B	Pentaerythritol Tetranitrate
HPLC/UV	EPA 8330A/8330B	1,3,5-Trinitrobenzene
HPLC/UV	EPA 8330A/8330B	2,4,6-Trinitrotoluene
HPLC/UV	EPA 8330A/8330B	Hexahydro-1,3-dinitroso-5- nitro-1,3,5,triazine (DNX)
HPLC/UV	EPA 8330A/8330B	Hexahydro-1,3,5-trinitroso- 1,3,5-triazine (TNX)
HPLC/UV	EPA 8330A/8330B	1-Nitroso-3,5-dinitro-1,3,5- triazacyclohexane (MNX)

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
HPLC/UV	EPA 8330A Modified / WS-LC-0010	Nitroguanidine
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	6:2 Fluorotelomer sulfonate (6:2 FTS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	8:2 Fluorotelomer sulfonate (8:2 FTS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	N-Ethyl perfluorooctanesulfon amidacetic acid (EtFOSAA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	N-Methyl perfluorooctanesulfon amidoacetic acide (MeFOSAA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorooctanoic acid (PFOA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorooctane Sulfonic Acid (PFOS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorobutyric acid (PFBA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluoropentanoic acid (PFPA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorohexanoic acid (PFHxA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluoroheptanoic acid (PFHpA)

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorononanoic acid (PFNA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorodecanoic acid (PFDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluoroundecanoic acid (PFUDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorododecanoic acid (PFDoDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorotridecanoic acid (PFTriA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorotetradecanoic acid (PDTeA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorobutane Sulfonic Acid (PFBS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorohexane Sulfonic Acid (PFHxS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluoroheptane Sulfonic Acid (PFHpS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluorodecane Sulfonic Acid (PFDS)

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 WS-LC-0025	Perfluoroocatane Sulfonamide (FOSA)
GC/HRMS	EPA 1668A/1668C	PCB 1
GC/HRMS	EPA 1668A/1668C	PCB 2
GC/HRMS	EPA 1668A/1668C	PCB 3
GC/HRMS	EPA 1668A/1668C	PCB 4
GC/HRMS	EPA 1668A/1668C	PCB 5
GC/HRMS	EPA 1668A/1668C	PCB 6
GC/HRMS	EPA 1668A/1668C	PCB 7
GC/HRMS	EPA 1668A/1668C	PCB 8
GC/HRMS	EPA 1668A/1668C	PCB 9
GC/HRMS	EPA 1668A/1668C	PCB 10
GC/HRMS	EPA 1668A/1668C	PCB 11
GC/HRMS	EPA 1668A/1668C	PCB 12
GC/HRMS	EPA 1668A/1668C	PCB 13
GC/HRMS	EPA 1668A/1668C	PCB 14
GC/HRMS	EPA 1668A/1668C	PCB 15
GC/HRMS	EPA 1668A/1668C	PCB 16
GC/HRMS	EPA 1668A/1668C	PCB 17
GC/HRMS	EPA 1668A/1668C	PCB 18
GC/HRMS	EPA 1668A/1668C	PCB 19
GC/HRMS	EPA 1668A/1668C	PCB 20
GC/HRMS	EPA 1668A/1668C	PCB 21
GC/HRMS	EPA 1668A/1668C	PCB 22
GC/HRMS	EPA 1668A/1668C	PCB 23
GC/HRMS	EPA 1668A/1668C	PCB 24
GC/HRMS	EPA 1668A/1668C	PCB 25
GC/HRMS	EPA 1668A/1668C	PCB 26
GC/HRMS	EPA 1668A/1668C	PCB 27
GC/HRMS	EPA 1668A/1668C	PCB 28
GC/HRMS	EPA 1668A/1668C	PCB 29
GC/HRMS	EPA 1668A/1668C	PCB 30
GC/HRMS	EPA 1668A/1668C	PCB 32
GC/HRMS	EPA 1668A/1668C	PCB 31
GC/HRMS	EPA 1668A/1668C	PCB 33

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/HRMS	EPA 1668A/1668C	PCB 34
GC/HRMS	EPA 1668A/1668C	PCB 35
GC/HRMS	EPA 1668A/1668C	PCB 36
GC/HRMS	EPA 1668A/1668C	PCB 37
GC/HRMS	EPA 1668A/1668C	PCB 38
GC/HRMS	EPA 1668A/1668C	PCB 39
GC/HRMS	EPA 1668A/1668C	PCB 40
GC/HRMS	EPA 1668A/1668C	PCB 41
GC/HRMS	EPA 1668A/1668C	PCB 42
GC/HRMS	EPA 1668A/1668C	PCB 43
GC/HRMS	EPA 1668A/1668C	PCB 44
GC/HRMS	EPA 1668A/1668C	PCB 45
GC/HRMS	EPA 1668A/1668C	PCB 46
GC/HRMS	EPA 1668A/1668C	PCB 47
GC/HRMS	EPA 1668A/1668C	PCB 48
GC/HRMS	EPA 1668A/1668C	PCB 49
GC/HRMS	EPA 1668A/1668C	PCB 50
GC/HRMS	EPA 1668A/1668C	PCB 51
GC/HRMS	EPA 1668A/1668C	PCB 52
GC/HRMS	EPA 1668A/1668C	PCB 53
GC/HRMS	EPA 1668A/1668C	PCB 54
GC/HRMS	EPA 1668A/1668C	PCB 55
GC/HRMS	EPA 1668A/1668C	PCB 56
GC/HRMS	EPA 1668A/1668C	PCB 57
GC/HRMS	EPA 1668A/1668C	PCB 58
GC/HRMS	EPA 1668A/1668C	PCB 59
GC/HRMS	EPA 1668A/1668C	PCB 60
GC/HRMS	EPA 1668A/1668C	PCB 61
GC/HRMS	EPA 1668A/1668C	PCB 62
GC/HRMS	EPA 1668A/1668C	PCB 63
GC/HRMS	EPA 1668A/1668C	PCB 64
GC/HRMS	EPA 1668A/1668C	PCB 65
GC/HRMS	EPA 1668A/1668C	PCB 66
GC/HRMS	EPA 1668A/1668C	PCB 67
GC/HRMS	EPA 1668A/1668C	PCB 68
GC/HRMS	EPA 1668A/1668C	PCB 69

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/HRMS	EPA 1668A/1668C	PCB 70
GC/HRMS	EPA 1668A/1668C	PCB 71
GC/HRMS	EPA 1668A/1668C	PCB 72
GC/HRMS	EPA 1668A/1668C	PCB 73
GC/HRMS	EPA 1668A/1668C	PCB 74
GC/HRMS	EPA 1668A/1668C	PCB 75
GC/HRMS	EPA 1668A/1668C	PCB 76
GC/HRMS	EPA 1668A/1668C	PCB 77
GC/HRMS	EPA 1668A/1668C	PCB 78
GC/HRMS	EPA 1668A/1668C	PCB 79
GC/HRMS	EPA 1668A/1668C	PCB 80
GC/HRMS	EPA 1668A/1668C	PCB 81
GC/HRMS	EPA 1668A/1668C	PCB 82
GC/HRMS	EPA 1668A/1668C	PCB 83
GC/HRMS	EPA 1668A/1668C	PCB 84
GC/HRMS	EPA 1668A/1668C	PCB 85
GC/HRMS	EPA 1668A/1668C	PCB 86
GC/HRMS	EPA 1668A/1668C	PCB 87
GC/HRMS	EPA 1668A/1668C	PCB 88
GC/HRMS	EPA 1668A/1668C	PCB 89
GC/HRMS	EPA 1668A/1668C	PCB 90
GC/HRMS	EPA 1668A/1668C	PCB 91
GC/HRMS	EPA 1668A/1668C	PCB 92
GC/HRMS	EPA 1668A/1668C	PCB 93
GC/HRMS	EPA 1668A/1668C	PCB 94
GC/HRMS	EPA 1668A/1668C	PCB 95
GC/HRMS	EPA 1668A/1668C	PCB 96
GC/HRMS	EPA 1668A/1668C	PCB 97
GC/HRMS	EPA 1668A/1668C	PCB 98
GC/HRMS	EPA 1668A/1668C	PCB 99
GC/HRMS	EPA 1668A/1668C	PCB 100
GC/HRMS	EPA 1668A/1668C	PCB 101
GC/HRMS	EPA 1668A/1668C	PCB 102
GC/HRMS	EPA 1668A/1668C	PCB 103
GC/HRMS	EPA 1668A/1668C	PCB 104
GC/HRMS	EPA 1668A/1668C	PCB 105

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/HRMS	EPA 1668A/1668C	PCB 106
GC/HRMS	EPA 1668A/1668C	PCB 107
GC/HRMS	EPA 1668A/1668C	PCB 108
GC/HRMS	EPA 1668A/1668C	PCB 109
GC/HRMS	EPA 1668A/1668C	PCB 110
GC/HRMS	EPA 1668A/1668C	PCB 111
GC/HRMS	EPA 1668A/1668C	PCB 112
GC/HRMS	EPA 1668A/1668C	PCB 113
GC/HRMS	EPA 1668A/1668C	PCB 114
GC/HRMS	EPA 1668A/1668C	PCB 115
GC/HRMS	EPA 1668A/1668C	PCB 116
GC/HRMS	EPA 1668A/1668C	PCB 117
GC/HRMS	EPA 1668A/1668C	PCB 118
GC/HRMS	EPA 1668A/1668C	PCB 119
GC/HRMS	EPA 1668A/1668C	PCB 120
GC/HRMS	EPA 1668A/1668C	PCB 121
GC/HRMS	EPA 1668A/1668C	PCB 122
GC/HRMS	EPA 1668A/1668C	PCB 123
GC/HRMS	EPA 1668A/1668C	PCB 124
GC/HRMS	EPA 1668A/1668C	PCB 125
GC/HRMS	EPA 1668A/1668C	PCB 126
GC/HRMS	EPA 1668A/1668C	PCB 127
GC/HRMS	EPA 1668A/1668C	PCB 128
GC/HRMS	EPA 1668A/1668C	PCB 129
GC/HRMS	EPA 1668A/1668C	PCB 130
GC/HRMS	EPA 1668A/1668C	PCB 131
GC/HRMS	EPA 1668A/1668C	PCB 132
GC/HRMS	EPA 1668A/1668C	PCB 133
GC/HRMS	EPA 1668A/1668C	PCB 134
GC/HRMS	EPA 1668A/1668C	PCB 135
GC/HRMS	EPA 1668A/1668C	PCB 136
GC/HRMS	EPA 1668A/1668C	PCB 137
GC/HRMS	EPA 1668A/1668C	PCB 138
GC/HRMS	EPA 1668A/1668C	PCB 139
GC/HRMS	EPA 1668A/1668C	PCB 140
GC/HRMS	EPA 1668A/1668C	PCB 141

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/HRMS	EPA 1668A/1668C	PCB 142
GC/HRMS	EPA 1668A/1668C	PCB 143
GC/HRMS	EPA 1668A/1668C	PCB 144
GC/HRMS	EPA 1668A/1668C	PCB 145
GC/HRMS	EPA 1668A/1668C	PCB 146
GC/HRMS	EPA 1668A/1668C	PCB 147
GC/HRMS	EPA 1668A/1668C	PCB 148
GC/HRMS	EPA 1668A/1668C	PCB 149
GC/HRMS	EPA 1668A/1668C	PCB 150
GC/HRMS	EPA 1668A/1668C	PCB 151
GC/HRMS	EPA 1668A/1668C	PCB 152
GC/HRMS	EPA 1668A/1668C	PCB 153
GC/HRMS	EPA 1668A/1668C	PCB 154
GC/HRMS	EPA 1668A/1668C	PCB 155
GC/HRMS	EPA 1668A/1668C	PCB 156
GC/HRMS	EPA 1668A/1668C	PCB 157
GC/HRMS	EPA 1668A/1668C	PCB 158
GC/HRMS	EPA 1668A/1668C	PCB 159
GC/HRMS	EPA 1668A/1668C	PCB 160
GC/HRMS	EPA 1668A/1668C	PCB 161
GC/HRMS	EPA 1668A/1668C	PCB 162
GC/HRMS	EPA 1668A/1668C	PCB 163
GC/HRMS	EPA 1668A/1668C	PCB 164
GC/HRMS	EPA 1668A/1668C	PCB 165
GC/HRMS	EPA 1668A/1668C	PCB 166
GC/HRMS	EPA 1668A/1668C	PCB 167
GC/HRMS	EPA 1668A/1668C	PCB 168
GC/HRMS	EPA 1668A/1668C	PCB 169
GC/HRMS	EPA 1668A/1668C	PCB 170
GC/HRMS	EPA 1668A/1668C	PCB 171
GC/HRMS	EPA 1668A/1668C	PCB 172
GC/HRMS	EPA 1668A/1668C	PCB 173
GC/HRMS	EPA 1668A/1668C	PCB 174
GC/HRMS	EPA 1668A/1668C	PCB 175
GC/HRMS	EPA 1668A/1668C	PCB 176
GC/HRMS	EPA 1668A/1668C	PCB 177

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/HRMS	EPA 1668A/1668C	PCB 178
GC/HRMS	EPA 1668A/1668C	PCB 179
GC/HRMS	EPA 1668A/1668C	PCB 180
GC/HRMS	EPA 1668A/1668C	PCB 181
GC/HRMS	EPA 1668A/1668C	PCB 182
GC/HRMS	EPA 1668A/1668C	PCB 183
GC/HRMS	EPA 1668A/1668C	PCB 184
GC/HRMS	EPA 1668A/1668C	PCB 185
GC/HRMS	EPA 1668A/1668C	PCB 186
GC/HRMS	EPA 1668A/1668C	PCB 187
GC/HRMS	EPA 1668A/1668C	PCB 188
GC/HRMS	EPA 1668A/1668C	PCB 189
GC/HRMS	EPA 1668A/1668C	PCB 190
GC/HRMS	EPA 1668A/1668C	PCB 191
GC/HRMS	EPA 1668A/1668C	PCB 192
GC/HRMS	EPA 1668A/1668C	PCB 193
GC/HRMS	EPA 1668A/1668C	PCB 194
GC/HRMS	EPA 1668A/1668C	PCB 195
GC/HRMS	EPA 1668A/1668C	PCB 196
GC/HRMS	EPA 1668A/1668C	PCB 197
GC/HRMS	EPA 1668A/1668C	PCB 198
GC/HRMS	EPA 1668A/1668C	PCB 199
GC/HRMS	EPA 1668A/1668C	PCB 200
GC/HRMS	EPA 1668A/1668C	PCB 201
GC/HRMS	EPA 1668A/1668C	PCB 202
GC/HRMS	EPA 1668A/1668C	PCB 203
GC/HRMS	EPA 1668A/1668C	PCB 204
GC/HRMS	EPA 1668A/1668C	PCB 205
GC/HRMS	EPA 1668A/1668C	PCB 206
GC/HRMS	EPA 1668A/1668C	PCB 207
GC/HRMS	EPA 1668A/1668C	PCB 208
GC/HRMS	EPA 1668A/1668C	PCB 209
Preparation	**Method**	**Type**
Acid Digestion (Aqueous)	EPA 3005A/3010A	Inorganics
Acid Digestion (Solid)	EPA 3050B	Inorganics
Separatory Funnel Liquid-Liquid Extraction	EPA 3510C	Semivolatile and Non-Volatile Organics

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
Ultrasonic Extraction	EPA 3550B/3550C	Semivolatile and Non-Volatile Organics
Solvent Dilution	EPA 3580A	Semivolatile and Non-Volatile Organics
Purge and Trap	EPA 5030B	Volatile Organic Compounds
Purge and Trap	EPA 5035/5035A	Volatile Organic Compounds
Microwave Extraction	EPA 3546	Semivolatile and Non-Volatile Organics
Florisil Cleanup	EPA 3620B/3620C	Cleanup of pesticide residues and other chlorinated hydrocarbons
Sulfur Cleanup	EPA 3660A	Sulfur Cleanup
Sulfuric Acid Cleanup	EPA 3665A	Sulfuric Acid Cleanup for PCBs
Silica Gel Cleanup	EPA 3630C	Column Cleanup
TCLP Extraction	EPA 1311	Toxicity Characteristic Leaching Procedure

Air and Emissions		
Technology	**Method**	**Analyte**
ICP-MS	EPA 6020/6020A	Aluminum
ICP-MS	EPA 6020/6020A	Antimony
ICP-MS	EPA 6020/6020A	Arsenic
ICP-MS	EPA 6020/6020A	Barium
ICP-MS	EPA 6020/6020A	Beryllium
ICP-MS	EPA 6020/6020A	Cadmium
ICP-MS	EPA 6020/6020A	Calcium
ICP-MS	EPA 6020/6020A	Chromium (Total)
ICP-MS	EPA 6020/6020A	Cobalt
ICP-MS	EPA 6020/6020A	Copper
ICP-MS	EPA 6020/6020A	Iron
ICP-MS	EPA 6020/6020A	Lead
ICP-MS	EPA 6020/6020A	Magnesium
ICP-MS	EPA 6020/6020A	Manganese
ICP-MS	EPA 6020/6020A	Molybdenum
ICP-MS	EPA 6020/6020A	Nickel
ICP-MS	EPA 6020/6020A	Potassium
ICP-MS	EPA 6020/6020A	Selenium
ICP-MS	EPA 6020/6020A	Silver
ICP-MS	EPA 6020/6020A	Sodium
ICP-MS	EPA 6020/6020A	Thallium

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Air and Emissions		
Technology	**Method**	**Analyte**
ICP-MS	EPA 6020/6020A	Vanadium
ICP-MS	EPA 6020/6020A	Zinc
Gravimetric	40CFR Part 50 App B	TSP (Total Suspended Particulate)
Gravimetric	40CFR Part 50 App J	PM10
GC/MS	EPA TO-14A/TO-15	1,1,1-Trichloroethane
GC/MS	EPA TO-14A/TO-15	1,1,2,2-Tetrachloroethane
GC/MS	EPA TO-14A/TO-15	1,1,2-Trichloroethane
GC/MS	EPA TO-14A/TO-15	1,1,2-Trichloro-1,2,2-trifluoroethane
GC/MS	EPA TO-14A/TO-15	1,1-Dichloroethane
GC/MS	EPA TO-14A/TO-15	1,1-Dichloroethene
GC/MS	EPA TO-14A/TO-15	1,2,3-Trichlorobenzene
GC/MS	EPA TO-14A/TO-15	1,2,3-Trichloropropane
GC/MS	EPA TO-14A/TO-15	1,2,4-Trichlorobenzene
GC/MS	EPA TO-14A/TO-15	1,2,4-Trimethylbenzene
GC/MS	EPA TO-14A/TO-15	1,2-Dibromoethane
GC/MS	EPA TO-14A/TO-15	1,2-Dichlorobenzene
GC/MS	EPA TO-14A/TO-15	1,2-Dichloroethane
GC/MS	EPA TO-14A/TO-15	1,2-Dichloropropane
GC/MS	EPA TO-14A/TO-15	1,3,5-Trimethylbenzene
GC/MS	EPA TO-14A/TO-15	1,3-Dichlorobenzene
GC/MS	EPA TO-14A/TO-15	1,4-Dichlorobenzene
GC/MS	EPA TO-14A/TO-15	1,4-Dioxane
GC/MS	EPA TO-14A/TO-15	2-Butanone (MEK)
GC/MS	EPA TO-14A/TO-15	2-Chlorotoluene
GC/MS	EPA TO-14A/TO-15	2-Hexanone (MBK)
GC/MS	EPA TO-14A/TO-15	2-Methyl-2-propanol (tert- Butyl Alcohol, TBA)
GC/MS	EPA TO-14A/TO-15	4-Ethyltoluene
GC/MS	EPA TO-14A/TO-15	4-Isopropyltoluene
GC/MS	EPA TO-14A/TO-15	4-Methyl-2-pentanone (MIBK)
GC/MS	EPA TO-14A/TO-15	Acetone
GC/MS	EPA TO-14A/TO-15	Acrolein
GC/MS	EPA TO-14A/TO-15	Allyl Chloride
GC/MS	EPA TO-14A/TO-15	Alpha Methyl Styrene
GC/MS	EPA TO-14A/TO-15	Benzene
GC/MS	EPA TO-14A/TO-15	Benzyl Chloride
GC/MS	EPA TO-14A/TO-15	Bromodichloromethane

Air and Emissions		
Technology	**Method**	**Analyte**
GC/MS	EPA TO-14A/TO-15	Bromoform
GC/MS	EPA TO-14A/TO-15	Bromomethane
GC/MS	EPA TO-14A/TO-15	Butadiene (1,3-Butadiene)
GC/MS	EPA TO-14A/TO-15	Butane
GC/MS	EPA TO-14A/TO-15	Carbon Disulfide
GC/MS	EPA TO-14A/TO-15	Carbon Tetrachloride
GC/MS	EPA TO-14A/TO-15	Chlorobenzene
GC/MS	EPA TO-14A/TO-15	Chlorodifluoromethane
GC/MS	EPA TO-14A/TO-15	Chloroethane
GC/MS	EPA TO-14A/TO-15	Chloroform
GC/MS	EPA TO-14A/TO-15	Chloromethane
GC/MS	EPA TO-14A/TO-15	cis-1,2-Dichloroethene
GC/MS	EPA TO-14A/TO-15	cis-1,3-Dichloropropene
GC/MS	EPA TO-14A/TO-15	Cyclohexane
GC/MS	EPA TO-14A/TO-15	Dibromochloromethane
GC/MS	EPA TO-14A/TO-15	Dibromomethane
GC/MS	EPA TO-14A/TO-15	Dichlorodifluoromethane
GC/MS	EPA TO-14A/TO-15	Ethyl Acetate
GC/MS	EPA TO-14A/TO-15	Ethylbenzene
GC/MS	EPA TO-14A/TO-15	Hexachlorobutadiene
GC/MS	EPA TO-14A/TO-15	Hexane
GC/MS	EPA TO-14A/TO-15	Isooctane (2,2,4- Trimethylpentane)
GC/MS	EPA TO-14A/TO-15	Isopropyl Alcohol
GC/MS	EPA TO-14A/TO-15	Isopropylbenzene
GC/MS	EPA TO-14A/TO-15	m & p Xylene
GC/MS	EPA TO-14A/TO-15	Methyl tert-butyl Ether (MTBE)
GC/MS	EPA TO-14A/TO-15	Methylene Chloride
GC/MS	EPA TO-14A/TO-15	Naphthalene
GC/MS	EPA TO-14A/TO-15	n-Butanol
GC/MS	EPA TO-14A/TO-15	n-Butylbenzene
GC/MS	EPA TO-14A/TO-15	n-Heptane
GC/MS	EPA TO-14A/TO-15	n-Nonane
GC/MS	EPA TO-14A/TO-15	n-Octane
GC/MS	EPA TO-14A/TO-15	n-Propylbenzene
GC/MS	EPA TO-14A/TO-15	o-Xylene
GC/MS	EPA TO-14A/TO-15	Pentane

Air and Emissions		
Technology	**Method**	**Analyte**
GC/MS	EPA TO-14A/TO-15	Propene
GC/MS	EPA TO-14A/TO-15	sec-Butylbenzene
GC/MS	EPA TO-14A/TO-15	Styrene
GC/MS	EPA TO-14A/TO-15	tert-Butylbenzene
GC/MS	EPA TO-14A/TO-15	Tetrachloroethene
GC/MS	EPA TO-14A/TO-15	Tetrahydrofuran
GC/MS	EPA TO-14A/TO-15	Toluene
GC/MS	EPA TO-14A/TO-15	trans-1,2-Dichloroethene
GC/MS	EPA TO-14A/TO-15	trans-1,3-Dichloropropene
GC/MS	EPA TO-14A/TO-15	Trichloroethene
GC/MS	EPA TO-14A/TO-15	Trichlorofluoromethane
GC/MS	EPA TO-14A/TO-15	Vinyl Acetate
GC/MS	EPA TO-14A/TO-15	Vinyl Bromide
GC/MS	EPA TO-14A/TO-15	Vinyl Chloride
GC/MS	EPA TO-14A/TO-15	Xylenes, Total
GC-FID/TCD	ASTM1946D / EPA 3C	Carbon Dioxide
GC-FID/TCD	ASTM1946D / EPA 3C	Nitrogen
GC-FID/TCD	ASTM1946D / EPA 3C	Oxygen
GC-FID/TCD	ASTM1946D / EPA 3C	Helium
GC-FID/TCD	ASTM1946D / EPA 3C	Hydrogen
GC-FID/TCD	ASTM1946D / EPA 3C	Methane
GC-FID/TCD	ASTM1946D / EPA 3C	Carbon Monoxide
GC/MS	EPA TO-14A/TO-15	Gasoline Range Organics (GRO)
GC/MS	EPA TO-14A/TO-15	TPH as Gasoline
GC/MS SIM	EPA TO-15 SIM	1,1,1-Trichloroethane
GC/MS SIM	EPA TO-15 SIM	1,1,2,2-Tetrachloroethane
GC/MS SIM	EPA TO-15 SIM	1,1,2-Trichloroethane
GC/MS SIM	EPA TO-15 SIM	1,1,2-Trichloro-1,2,2-trifluoroethane
GC/MS SIM	EPA TO-15 SIM	1,1-Dichloroethane
GC/MS SIM	EPA TO-15 SIM	1,1-Dichloroethene
GC/MS SIM	EPA TO-15 SIM	1,2,3-Trichloropropane
GC/MS SIM	EPA TO-15 SIM	1,2,4-Trichlorobenzene
GC/MS SIM	EPA TO-15 SIM	1,2-Dibromoethane
GC/MS SIM	EPA TO-15 SIM	1,2-Dichlorobenzene
GC/MS SIM	EPA TO-15 SIM	1,2-Dichloroethane
GC/MS SIM	EPA TO-15 SIM	1,2-Dichloropropane

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Air and Emissions		
Technology	**Method**	**Analyte**
GC/MS SIM	EPA TO-15 SIM	1,3-Dichlorobenzene
GC/MS SIM	EPA TO-15 SIM	1,4-Dichlorobenzene
GC/MS SIM	EPA TO-15 SIM	1,4-Dioxane
GC/MS SIM	EPA TO-15 SIM	Acrolein
GC/MS SIM	EPA TO-15 SIM	Benzene
GC/MS SIM	EPA TO-15 SIM	Benzyl Chloride
GC/MS SIM	EPA TO-15 SIM	Bromodichloromethane
GC/MS SIM	EPA TO-15 SIM	Butadiene (1,3-Butadiene)
GC/MS SIM	EPA TO-15 SIM	Carbon Tetrachloride
GC/MS SIM	EPA TO-15 SIM	Chlorobenzene
GC/MS SIM	EPA TO-15 SIM	Chloroethane
GC/MS SIM	EPA TO-15 SIM	Chloroform
GC/MS SIM	EPA TO-15 SIM	Chloromethane
GC/MS SIM	EPA TO-15 SIM	cis-1,2-Dichloroethene
GC/MS SIM	EPA TO-15 SIM	cis-1,3-Dichloropropene
GC/MS SIM	EPA TO-15 SIM	Dibromochloromethane
GC/MS SIM	EPA TO-15 SIM	Dichlorodifluoromethane
GC/MS SIM	EPA TO-15 SIM	Ethylbenzene
GC/MS SIM	EPA TO-15 SIM	Hexachlorobutadiene
GC/MS SIM	EPA TO-15 SIM	m & p Xylene
GC/MS SIM	EPA TO-15 SIM	Methyl tert-butyl Ether (MTBE)
GC/MS SIM	EPA TO-15 SIM	Methylene Chloride
GC/MS SIM	EPA TO-15 SIM	Naphthalene
GC/MS SIM	EPA TO-15 SIM	o-Xylene
GC/MS SIM	EPA TO-15 SIM	Styrene
GC/MS SIM	EPA TO-15 SIM	Tetrachloroethene
GC/MS SIM	EPA TO-15 SIM	Toluene
GC/MS SIM	EPA TO-15 SIM	trans-1,2-Dichloroethene
GC/MS SIM	EPA TO-15 SIM	trans-1,3-Dichloropropene
GC/MS SIM	EPA TO-15 SIM	Trichloroethene
GC/MS SIM	EPA TO-15 SIM	Trichlorofluoromethane
GC/MS SIM	EPA TO-15 SIM	Vinyl Chloride
GC/MS SIM	EPA TO-15 SIM	Xylenes, Total
GC/MS	EPA TO-13A	1,2,4-Trichlorobenzene
GC/MS	EPA TO-13A	1,2-Dichlorobenzene
GC/MS	EPA TO-13A	1,3-Dichlorobenzene

ANSI-ASQ National Accreditation Board

Air and Emissions		
Technology	**Method**	**Analyte**
GC/MS	EPA TO-13A	1,3-Dinitrobenzene
GC/MS	EPA TO-13A	1,4-Dichlorobenzene
GC/MS	EPA TO-13A	1-Methylnaphthalene
GC/MS	EPA TO-13A	2,3,4,6-Tetrachlorophenol
GC/MS	EPA TO-13A	2,4,5-Trichlorophenol
GC/MS	EPA TO-13A	2,4,6-Trichlorophenol
GC/MS	EPA TO-13A	2,4-Dichlorophenol
GC/MS	EPA TO-13A	2,4-Dimethylphenol
GC/MS	EPA TO-13A	2,4-Dinitrophenol
GC/MS	EPA TO-13A	2,4-Dinitrotoluene
GC/MS	EPA TO-13A	2,6-Dichlorophenol
GC/MS	EPA TO-13A	2,6-Dinitrotoluene
GC/MS	EPA TO-13A	2-Chloronaphthalene
GC/MS	EPA TO-13A	2-Chlorophenol
GC/MS	EPA TO-13A	2-Methylnaphthalene
GC/MS	EPA TO-13A	2-Methylphenol
GC/MS	EPA TO-13A	2-Nitroaniline
GC/MS	EPA TO-13A	2-Nitrophenol
GC/MS	EPA TO-13A	3&4-Methylphenol
GC/MS	EPA TO-13A	3,3'-Dichlorobenzidine
GC/MS	EPA TO-13A	3-Nitroaniline
GC/MS	EPA TO-13A	4,6-Dinitro-2-methylphenol
GC/MS	EPA TO-13A	4-Bromophenyl phenyl ether
GC/MS	EPA TO-13A	4-Chloro-3-methylphenol
GC/MS	EPA TO-13A	4-Chloroaniline
GC/MS	EPA TO-13A	4-Chlorophenyl phenyl ether
GC/MS	EPA TO-13A	4-Nitroaniline
GC/MS	EPA TO-13A	4-Nitrophenol
GC/MS	EPA TO-13A	Acenaphthene
GC/MS	EPA TO-13A	Acenaphthylene
GC/MS	EPA TO-13A	Aniline
GC/MS	EPA TO-13A	Anthracene
GC/MS	EPA TO-13A	Benzo(a)anthracene
GC/MS	EPA TO-13A	Benzo(a)pyrene
GC/MS	EPA TO-13A	Benzo(b)fluoranthene
GC/MS	EPA TO-13A	Benzo(g,h,i)perylene

ANSI-ASQ National Accreditation Board

ANAB

Air and Emissions		
Technology	**Method**	**Analyte**
GC/MS	EPA TO-13A	Benzo(k)fluoranthene
GC/MS	EPA TO-13A	Benzoic Acid
GC/MS	EPA TO-13A	Benzyl Alcohol
GC/MS	EPA TO-13A	Benzyl butyl Phthalate
GC/MS	EPA TO-13A	Biphenyl
GC/MS	EPA TO-13A	Bis(2-chloroethoxy) Methane
GC/MS	EPA TO-13A	Bis(2-chloroethyl) Ether
GC/MS	EPA TO-13A	Bis(2-chloroisopropyl) Ether
GC/MS	EPA TO-13A	Carbazole
GC/MS	EPA TO-13A	Chrysene
GC/MS	EPA TO-13A	Bis (2-ethylhexyl) Phthalate
GC/MS	EPA TO-13A	Dibenz(a,h)anthracene
GC/MS	EPA TO-13A	Dibenzofuran
GC/MS	EPA TO-13A	Diethyl Phthalate
GC/MS	EPA TO-13A	Dimethyl Phthalate
GC/MS	EPA TO-13A	Di-n-butyl Phthalate
GC/MS	EPA TO-13A	Di-n-octyl Phthalate
GC/MS	EPA TO-13A	Fluoranthene
GC/MS	EPA TO-13A	Fluorene
GC/MS	EPA TO-13A	Hexachlorobenzene
GC/MS	EPA TO-13A	Hexachlorobutadiene
GC/MS	EPA TO-13A	Hexachlorocyclopentadiene
GC/MS	EPA TO-13A	Hexachloroethane
GC/MS	EPA TO-13A	Indeno(1,2,3-c,d) Pyrene
GC/MS	EPA TO-13A	Isophorone
GC/MS	EPA TO-13A	Naphthalene
GC/MS	EPA TO-13A	Nitrobenzene
GC/MS	EPA TO-13A	n-Nitrosodimethylamine
GC/MS	EPA TO-13A	n-Nitrosodi-n-propylamine
GC/MS	EPA TO-13A	n-Nitrosodiphenylamine
GC/MS	EPA TO-13A	Pentachlorophenol
GC/MS	EPA TO-13A	Phenanthrene
GC/MS	EPA TO-13A	Phenol
GC/MS	EPA TO-13A	Pyrene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	1-Methylnaphthalene

Air and Emissions		
Technology	**Method**	**Analyte**
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	2-Methylnaphthalene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Acenaphthene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Acenaphthylene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Anthracene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Benzo(a)anthracene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Benzo(a)pyrene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Benzo(b)fluoranthene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Benzo(g,h,i)perylene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Benzo(k)fluoranthene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Chrysene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Fluoranthene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Fluorene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Indeno(1,2,3-c,d) Pyrene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Naphthalene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Phenanthrene
GC/MS SIM	EPA TO-13A SIM / WS-MS-0006	Pyrene
GC-ECD	EPA TO-4A/TO-10A	PCB-1016
GC-ECD	EPA TO-4A/TO-10A	PCB-1221
GC-ECD	EPA TO-4A/TO-10A	PCB-1232
GC-ECD	EPA TO-4A/TO-10A	PCB-1242
GC-ECD	EPA TO-4A/TO-10A	PCB-1248
GC-ECD	EPA TO-4A/TO-10A	PCB-1254
GC-ECD	EPA TO-4A/TO-10A	PCB-1260

ANSI-ASQ National Accreditation Board

Air and Emissions		
Technology	**Method**	**Analyte**
GC-ECD	EPA TO-4A/TO-10A	PCB-1262
GC-ECD	EPA TO-4A/TO-10A	PCB-1268
Preparation	**Method**	**Type**
Acid Digestion (Filters, Solid)	EPA 3050B	Inorganics
Soxhlet extraction of PUF	TO-4A/TO-10A	PCBs in Air
Soxhlet extraction of PUF/XAD	TO-13	Semivolatiles in Air
Florisil Cleanup	EPA 3620B/3620C	Cleanup of pesticide residues and other chlorinated hydrocarbons
Sulfur Cleanup	EPA 3660A	Sulfur Cleanup
Sulfuric Acid Cleanup	EPA 3665A	Sulfuric Acid Cleanup for PCBs

Note:

1. This scope is formatted as part of a single document including Certificate of Accreditation No. L2468

Vice President

CALIFORNIA
Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

Interim

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

CERTIFICATE OF ENVIRONMENTAL ACCREDITATION

Is hereby granted to

TestAmerica Sacramento

TestAmerica Laboratories, Inc.

880 Riverside Parkway

West Sacramento, CA 95605

Scope of the certificate is limited to the
"Fields of Testing"
which accompany this Certificate.

Continued accredited status depends on successful completion of on-site inspection, proficiency testing studies, and payment of applicable fees.

This Certificate is granted in accordance with provisions of Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **2897**

Expiration Date: **1/31/2019**

Effective Date: **2/1/2018**

Sacramento, California
subject to forfeiture or revocation

Christine Sotelo, Chief
Environmental Laboratory Accreditation Program

CALIFORNIA
Water Boards

EDMUND G. BROWN JR.
GOVERNOR

MATTHEW RODRIQUEZ
SECRETARY FOR
ENVIRONMENTAL PROTECTION

State Water Resources Control Board

January 10, 2018

Crystal Pollock
TestAmerica Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Dear Crystal Pollock: Certificate No. 2897

This is to advise you that the laboratory named above has been granted an interim certificate pursuant to California Health and Safety Code (HSC), Division 101, Part 1, Chapter 4, Section 100850(d).

The Fields of Testing for which this laboratory has been granted interim certification is shown in the enclosed "Fields of Testing". The Interim certificate shall remain in effect until **January 31, 2019** or until a certificate pursuant to HSC 100825(a) is issued.

Your laboratory is required to participate in the appropriate performance evaluation studies and to perform acceptably in such studies as stated in HSC 100870 and Title 22 of the California Code of Regulations Section 64809. Continued compliance with the Environmental Laboratory Accreditation Program statutes and regulations is required for maintaining the interim certification status.

Any changes in laboratory location or structural alterations, which may adversely affect the quality of analysis in the fields of testing for which the laboratory has been granted certification, require prior notification. Notification is also required for changes in ownership or laboratory director within 30 days after the change (HSC 100845(b) and (d)).

Contact our office at (916) 323-3431 or elapca@waterboards.ca.gov for questions.

Sincerely,

Christine Sotelo

Christine Sotelo, Chief
Environmental Laboratory Accreditation Program

Enclosure

CALIFORNIA STATE
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM
Accredited Fields of Testing

TestAmerica Sacramento
TestAmerica Laboratories, Inc.
880 Riverside Parkway
West Sacramento, CA 95605
Phone: (916) 373-5600

Certificate No. 2897
Expiration Date 1/31/2019
INTERIM

Field of Testing: 102 - Inorganic Chemistry of Drinking Water				
102.045	001	Perchlorate	EPA 314.0	
102.047	001	Perchlorate	EPA 331.0	
Field of Testing: 105 - Semi-volatile Organic Chemistry of Drinking Water				
105.230	000	Dioxins	EPA 1613B	Interim
105.230	001	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	EPA 1613B	
Field of Testing: 108 - Inorganic Chemistry of Wastewater				
108.112	001	Boron	EPA 200.7	
108.112	002	Calcium	EPA 200.7	
108.112	003	Hardness (calculation)	EPA 200.7	
108.112	004	Magnesium	EPA 200.7	
108.112	005	Potassium	EPA 200.7	
108.112	007	Sodium	EPA 200.7	
108.113	002	Calcium	EPA 200.8	
108.113	003	Magnesium	EPA 200.8	
108.113	004	Potassium	EPA 200.8	
108.120	001	Bromide	EPA 300.0	
108.120	002	Chloride	EPA 300.0	
108.120	003	Fluoride	EPA 300.0	
108.120	008	Sulfate	EPA 300.0	
108.120	012	Nitrate (as N)	EPA 300.0	
108.120	012	Nitrate (as N)	EPA 300.0	
108.120	014	Nitrite (as N)	EPA 300.0	
108.120	014	Nitrite (as N)	EPA 300.0	
108.120	015	Phosphate, Ortho (as P)	EPA 300.0	
108.232	003	Nitrate-Nitrite (as N)	EPA 353.2	
108.232	004	Nitrite (as N)	EPA 353.2	
108.232	004	Nitrite (as N)	EPA 353.2	Interim
108.323	001	Chemical Oxygen Demand	EPA 410.4	
108.410	001	Alkalinity	SM2320B-1997	
108.420	001	Hardness (calculation)	SM2340B-1997	Interim
108.430	001	Conductivity	SM2510B-1997	
108.430	001	Conductivity	SM2510B-1997	Interim
108.490	001	Hydrogen Ion (pH)	SM4500-H+ B-2000	Interim
108.528	003	Nitrate (as N) (Calculation)	SM4500-NO3- E-2000	Interim
Field of Testing: 109 - Toxic Chemical Elements of Wastewater				
109.010	001	Aluminum	EPA 200.7	
109.010	002	Antimony	EPA 200.7	

109.010	003	Arsenic	EPA 200.7	
109.010	004	Barium	EPA 200.7	
109.010	005	Beryllium	EPA 200.7	
109.010	006	Boron	EPA 200.7	
109.010	007	Cadmium	EPA 200.7	
109.010	009	Chromium	EPA 200.7	
109.010	010	Cobalt	EPA 200.7	
109.010	011	Copper	EPA 200.7	
109.010	012	Iron	EPA 200.7	
109.010	013	Lead	EPA 200.7	
109.010	015	Manganese	EPA 200.7	
109.010	016	Molybdenum	EPA 200.7	
109.010	017	Nickel	EPA 200.7	
109.010	019	Selenium	EPA 200.7	
109.010	021	Silver	EPA 200.7	
109.010	023	Thallium	EPA 200.7	
109.010	024	Tin	EPA 200.7	
109.010	025	Titanium	EPA 200.7	
109.010	026	Vanadium	EPA 200.7	
109.010	027	Zinc	EPA 200.7	
109.020	001	Aluminum	EPA 200.8	
109.020	002	Antimony	EPA 200.8	
109.020	003	Arsenic	EPA 200.8	
109.020	004	Barium	EPA 200.8	
109.020	005	Beryllium	EPA 200.8	
109.020	006	Cadmium	EPA 200.8	
109.020	007	Chromium	EPA 200.8	
109.020	008	Cobalt	EPA 200.8	
109.020	009	Copper	EPA 200.8	
109.020	010	Lead	EPA 200.8	
109.020	011	Manganese	EPA 200.8	
109.020	012	Molybdenum	EPA 200.8	
109.020	013	Nickel	EPA 200.8	
109.020	014	Selenium	EPA 200.8	
109.020	015	Silver	EPA 200.8	
109.020	016	Thallium	EPA 200.8	
109.020	017	Vanadium	EPA 200.8	
109.020	018	Zinc	EPA 200.8	
109.020	021	Iron	EPA 200.8	
109.020	022	Tin	EPA 200.8	
109.020	023	Titanium	EPA 200.8	

Field of Testing: 110 - Volatile Organic Chemistry of Wastewater

110.040	000	Purgeable Organic Compounds	EPA 624	

Field of Testing: 111 - Semi-volatile Organic Chemistry of Wastewater

111.111	000	Dioxins and Dibenzofurans	EPA 1613B	
111.170	000	Organochlorine Pesticides and PCBs	EPA 608	Interim

Field of Testing: 114 - Inorganic Chemistry of Hazardous Waste

114.010	001	Antimony	EPA 6010B	
114.010	002	Arsenic	EPA 6010B	
114.010	003	Barium	EPA 6010B	
114.010	004	Beryllium	EPA 6010B	
114.010	005	Cadmium	EPA 6010B	
114.010	006	Chromium	EPA 6010B	
114.010	007	Cobalt	EPA 6010B	
114.010	008	Copper	EPA 6010B	
114.010	009	Lead	EPA 6010B	
114.010	010	Molybdenum	EPA 6010B	
114.010	011	Nickel	EPA 6010B	
114.010	012	Selenium	EPA 6010B	
114.010	013	Silver	EPA 6010B	
114.010	014	Thallium	EPA 6010B	
114.010	015	Vanadium	EPA 6010B	
114.010	016	Zinc	EPA 6010B	
114.020	001	Antimony	EPA 6020	
114.020	002	Arsenic	EPA 6020	
114.020	003	Barium	EPA 6020	
114.020	004	Beryllium	EPA 6020	
114.020	005	Cadmium	EPA 6020	
114.020	006	Chromium	EPA 6020	
114.020	007	Cobalt	EPA 6020	
114.020	008	Copper	EPA 6020	
114.020	009	Lead	EPA 6020	
114.020	010	Molybdenum	EPA 6020	
114.020	011	Nickel	EPA 6020	
114.020	012	Selenium	EPA 6020	
114.020	013	Silver	EPA 6020	
114.020	014	Thallium	EPA 6020	
114.020	015	Vanadium	EPA 6020	
114.020	016	Zinc	EPA 6020	
114.103	001	Chromium (VI)	EPA 7196A	
114.140	001	Mercury	EPA 7470A	
114.141	001	Mercury	EPA 7471A	
114.240	001	Corrosivity - pH Determination	EPA 9040B	
114.241	001	Corrosivity - pH Determination	EPA 9045C	
114.250	001	Fluoride	EPA 9056	

Field of Testing: 115 - Extraction Test of Hazardous Waste

115.020	001	Toxicity Characteristic Leaching Procedure (TCLP)	EPA 1311	Interim
115.021	001	TCLP Inorganics	EPA 1311	
115.022	001	TCLP Extractables	EPA 1311	
115.030	001	Waste Extraction Test (WET)	CCR Chapter11, Article 5, Appendix II	
115.040	001	Synthetic Precipitation Leaching Procedure (SPLP)	EPA 1312	

Field of Testing: 116 - Volatile Organic Chemistry of Hazardous Waste

116.080	000	Volatile Organic Compounds	EPA 8260B	
116.080	120	Oxygenates	EPA 8260B	
116.100	001	Total Petroleum Hydrocarbons - Gasoline	LUFT GC/MS	
116.100	010	BTEX and MTBE	LUFT GC/MS	

Field of Testing: 117 - Semi-volatile Organic Chemistry of Hazardous Waste

117.010	001	Diesel-range Total Petroleum Hydrocarbons	EPA 8015B	
117.016	001	Diesel-range Total Petroleum Hydrocarbons	LUFT	
117.110	000	Extractable Organics	EPA 8270C	
117.120	000	Dioxins and Dibenzofurans	EPA 8280A	
117.130	000	Dioxins and Dibenzofurans	EPA 8290	
117.170	000	Nitroaromatics and Nitramines	EPA 8330	
117.171	000	Nitroaromatics and Nitramines	EPA 8330A	
117.210	000	Organochlorine Pesticides	EPA 8081A	Interim
117.220	000	PCBs	EPA 8082	

APPENDIX B

WASTE MANAGEMENT PLAN

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Naval Facilities Engineering Command Southwest
BRAC PMO West
San Diego, CA

FINAL
REMEDIAL ACTION/NON-TIME CRITICAL REMOVAL ACTION WASTE MANAGEMENT PLAN

Installation Restoration Site 12

Report and Tables 1 and 2, Attachments 1 and 2

Former Naval Station Treasure Island, San Francisco, CA

September 2018

Approved for public release; distribution is unlimited

DCN: GLBN-0005-4239-0011

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Naval Facilities Engineering Command Southwest
BRAC PMO West
San Diego, CA

FINAL
REMEDIAL ACTION/NON-TIME CRITICAL REMOVAL ACTION WASTE MANAGEMENT PLAN

Installation Restoration Site 12

Report and Tables 1 and 2, Attachments 1 and 2

Former Naval Station Treasure Island, San Francisco, CA

September 2018

Prepared for:

Department of the Navy
Naval Facilities Engineering Command Southwest
1220 Pacific Highway
San Diego, CA 92132

Prepared by:

GILBANE FEDERAL
1655 Grant Street, Suite 1200
Concord, CA 94520

Contract Number: N62473-17-D-0005; Task Order: N6247317F4239

DCN: GLBN-0005-4239-0011

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF ATTACHMENTS

LIST OF ACRONYMS AND ABBREVIATIONS

ACM	asbestos-containing material(s)
APP	Accident Prevention Plan
BMPs	best management practices
BRAC	Base Realignment and Closure
CCSF	City and County of San Francisco
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COCs	contaminants of concern
CQCP	Contractor Quality Control Plan
CSO	Caretaker Site Office
CTO	Contract Task Order
DOT	Department of Transportation
EPP	Environmental Protection Plan
Gilbane	Gilbane Federal
HSP	Health and Safety Plan
ID	identification
IDW	investigative-derived waste
IR	Installation Restoration
LBP	Lead Based Paint
LDR	Land Disposal Restriction
LLRW	low level radiological waste
NAVFAC SW	Naval Facilities Engineering Command Southwest
Navy	United States Department of the Navy
NPDES	National Pollutant Discharge Elimination System
NSTI	former Naval Station Treasure Island
NSWDA	non-Solid Waste Disposal Area
NTCRA	non-Time Critical Removal Action
PPE	personal protective equipment
QC	quality control
QCM	Quality Control Manager
RACR	Remedial Action Completion Report
RASO	Radiological Affairs Support Office
RCA	radiologically controlled area
RCRA	Resource Conservation and Recovery Act
RMDP	Radiological Management and Demolition Plan
ROICC	Resident Officer in Charge of Construction
RPM	Remedial Project Manager
RSY	radiological screening yard
SAP	Sampling and Analysis Plan
SSHO	Site Safety Health Officer
SSHP	Site Safety and Health Plan
SWDA	Solid Waste Disposal Area

T&D	transport and disposal
TSDF	treatment, storage, and disposal facility
USEPA	United States Environmental Protection Agency
Water Board	California Regional Water Quality Control Board, San Francisco Bay Region
WMP	Waste Management Plan

1.0 INTRODUCTION

This Waste Management Plan (WMP) was prepared and will be implemented by Gilbane Federal (Gilbane), under Contract No. N62473-17-D-0005, Contract Task Order F4239. This WMP describes plans for the management of wastes anticipated during implementation of the remedial action activities to be performed in the non-Solid Waste Disposal Areas (SWDA) within Installation Restoration (IR) Site 12 (Old Bunker Area) and to continue the Site 12 non-time critical removal action (NTCRA) at the Northpoint SWDA at the former Naval Station Treasure Island (NSTI) in San Francisco, California (refer to Figure 1 in the Remedial Action / NTCRA Work Plan). A secondary goal of this WMP is to ensure that waste minimization practices are followed, to the extent practicable, and to reduce the volume of waste that will be generated, stored, and removed from the site for disposal.

This WMP covers both wastes to be remediated under this task order and investigative-derived waste (IDW) generated during the remediation activities. The wastes expected by types, generation, storage, sampling and analysis, waste profiling, transportation, and ultimate disposal of waste are documented in this WMP. The wastes generated at the site will be transported and disposed of in a cost-effective, timely, and compliant manner. Details regarding radiological, asbestos containing material (ACM), and/or lead-based paint (LBP) waste are provided separately in the Radiological Management and Demolition Plan (RMDP) submitted as Appendix E of the Remedial Action / NTCRA Work Plan.

2.0 ANTICIPATED WASTE STREAMS

In addition to radioactive, mixed, and hazardous wastes that are addressed in the RMDP of the RA / NTCRA, anticipated waste includes salvageable or recyclable materials that would otherwise be discarded or destroyed, and materials that cannot be salvaged or recycled.

2.1 SALVAGEABLE OR RECYCLABLE WASTE

Salvageable or recyclable waste includes the following:

- Metals: metal scrap including beverage containers, packaging materials, fencing; does not include metal removed from radiologically controlled project areas or metal used to cut or grind metal from that area.
- Untreated Wood: unpainted, untreated dimensional lumber, wood edging, wood shipping pallets, etc.; does not include pressure treated or creosote treated wood or wood removed from the project area.
- Cardboard: clean, corrugated cardboard such as used for packaging, etc.

2.2 HANDLING AND STORAGE

Waste will be handled and stored properly pending disposal. Waste will be stored temporarily at locations approved by the Navy to allow sufficient quantities for economical shipment and disposal, or to coordinate shipments between the carrier and the disposal site.

2.3 MINIMIZATION

Waste minimization techniques will be applied to reduce the types and quantities of wastes generated. The work site, including storage areas, will be maintained at all times free from accumulations of waste materials, trash or rubbish. Good housekeeping practices will be used at all times. Work areas will be cleaned up daily and housekeeping performed after each job is completed.

2.4 PROCESSING

Specific areas will be defined to facilitate separation of materials for recycling, salvage, reuse or return. Staging areas of building demolition debris will be used by Gilbane to segregate equipment and material by commodity type (stainless steel, steel, copper wire, aluminum conductor, and breakage), resized if necessary to facilitate material handling and waste processing. Identified recyclable and salvageable waste products will be separated, stored, protected, and handled at the project site to prevent contamination of materials and maximize recyclability and salvage ability of materials.

2.5 RECYCLABLE WASTE

Reusable or recyclable devices and material removed by Gilbane, such as working or repairable devices and equipment determined not to be waste, will be turned over to the Navy. Paper and beverage containers used by on-site workers will be recycled.

2.6 NON-RECYCLABLE WASTE

Except for items or materials to be salvaged, recycled, or otherwise reused, waste materials will be removed by Gilbane from project site and legally disposed in a landfill acceptable to authorities having jurisdiction. Debris will be removed and transported in a manner that will prevent spillage on adjacent surfaces and areas. No burning, dumping or disposal of trash on-site is allowed.

3.0 COORDINATION RESPONSIBILITIES OF TRANSPORTATION AND DISPOSAL

A transport and disposal (T&D) Coordinator will manage waste T&D activities, including contacting and scheduling the trucking companies and coordinating profiles and manifests with the Caretaker Site Office (CSO), currently housed at former NSTI. No shipments of waste will leave the site without a Navy signature. The T&D Coordinator will direct and track all shipments and provide a report to the Quality Control Manager (QCM) detailing the specifics of the management of the waste, including tonnage and date of shipment on each day that materials are shipped. The T&D Coordinator will ensure that the Navy coordinator receives the proper copies of signed manifests (after generator and transporter have signed) as well as all waste acceptance letters and certificates of disposal/destruction. The T&D Coordinator will receive the waste acceptance letters from the disposal facilities for inclusion into the RACR.

4.0 WASTE MINIMIZATION

To minimize the volume of waste, the following general guidelines will be followed.

- Field personnel will be trained in decontamination of field sampling equipment and PPE, minimizing the generation of decontamination water.
- Field personnel will be trained in the proper use of PPE. Based on the anticipated low site exposures (as outlined in the Health and Safety Plan [HSP]), work will largely be performed in Level D wear, thereby minimizing PPE.
- Materials will not be contaminated unnecessarily.
- To eliminate the possibility of creating mixed waste, buildings will be radiologically surveyed and cleared prior to hazardous waste abatement. Likewise, to minimize the creation of additional hazardous waste, hazardous waste abatement will be performed prior to building demolition. The resulting demolition waste can then be disposed as construction debris in a Class III landfill. Similarly, excavated soil is chemically sampled for waste characterization, but also radiologically screened to eliminate the potential concern regarding the waste being mixed (i.e., chemically and radioactively contaminated), which requires special handling and higher disposal costs.
- Work will be planned ahead, based on the work procedure to be used.
- Only the material (e.g., chemicals) needed to perform the work activity will be taken to the work location.
- Additional material can be brought to the work location if it is found to be necessary.
- Materials can be stored in large containers, but the smallest reasonable container will be used to transport the material to the location where it is needed.
- Cleaning and extra sampling supplies will be maintained outside any potentially contaminated area to keep them clean and to minimize additional waste generation.
- Mixing of detergents or decontamination solutions will be performed outside potentially contaminated areas.
- Containers will be used to minimize the spread of contamination.
- Contaminated materials will not be placed with clean materials.
- Wooden pallets inside the exclusion zone will be covered with plastic.
- Material and equipment will be decontaminated and reused when practical.
- Volume reduction techniques will be used when practicable.
- Waste containers will be verified to ensure they are solidly packed to minimize the number of containers.
- Only waste containers with adequate size to contain the volume of waste generated will be used.

- Less hazardous substances will be used whenever possible (i.e., only the volume of standard solutions needed for testing will be brought; minimal amounts of decontamination water and solvent rinses will be used).

5.0 TRANSPORTATION AND DISPOSAL ACTIVITIES

This section describes the specific T&D activities in a chronological sequence at NSTI Site 12. Waste will be managed by type based on waste stream characteristics and disposal facility requirements. Measures will be taken to avoid comingling of waste types from demolition or excavation through handling and transport for disposal.

5.1 WASTE GENERATION, ACCUMULATION, AND HANDLING

Resultant waste streams associated with project activities can be categorized as follows:

- Post remediation construction/demolition debris;
- Universal waste;
- Stockpiled soil from excavation;
- Free product, if encountered, in the open excavation;
- Wastewater;
- Used personal protective equipment (PPE); and
- Disposable sampling equipment and materials.

Wastes will be segregated and accumulated into the categories outlined in Table 1. Wastes from different sources will be additionally segregated by each individual source. The T&D Coordinator will then review available information and determine whether the wastes from different sources can be commingled for both cost and handling efficiency. Attachment 1 provides the Waste Inventory Log that will be used to track project wastes. Attachment 2 provides the Waste Storage Area Inspection Checklist that will be used to inspect each waste storage area on a weekly basis.

Universal waste, such as fluorescent lamps and tubes, mercury switches, and batteries, will be removed from the buildings prior to demolition and will be packaged, labeled and disposed or recycled in accordance with California’s Universal Waste Rule, 22 CCR 23.

Free product, if encountered, will be stored in 55-gallon drums, appropriately labeled, and stored within a common staging area away from the excavation sites. It will be disposed of at a recycling facility if it is acceptable to the disposal facility based on characterization.

Solid waste from field activities, including PPE, disposable supplies, and materials used during sampling activities, will be double-bagged and disposed of as municipal waste, unless site conditions indicate that more stringent disposal requirements are required.

Tanks and containers will be handled as potentially hazardous and an "Analysis Pending – Potentially Hazardous Waste" label will be used on the drums until analytical results are available. Solid waste and liquid waste containers will be labeled with the following information: date, project name and number, generator name, POC name, applicable contact numbers, contents of drum, and the location identification for where the waste was generated. Empty containers will be labeled as such to avoid confusion. The method of disposal will be determined based on the analytical results.

5.2 WASTE CHARACTERIZATION/CLASSIFICATION

Applicable waste (including but not limited to soil cuttings from soil borings, purged groundwater, and excavated soil) will be sampled and analyzed for characterization purposes and in accordance with the disposal facility waste acceptance criteria. Additional waste characterization will be performed as needed following stockpiling to determine exact disposal volumes and requirements.

5.2.1 Waste Analysis

Representative samples for waste characterization will be obtained and additional grab samples for comparison to applicable U.S. Environmental Protection Agency/California Department of Toxic and Substance Control land disposal restrictions may also be collected. Waste water samples will be taken when accumulation of liquids is completed or no later than 90 days after accumulation of liquids commenced to verify hazardous waste has not been generated.

5.2.2 Waste Profiling

Waste profiles will be completed for both hazardous and nonhazardous wastes, as applicable, once analytical results have been received and waste is characterized for disposal in accordance with applicable regulatory and disposal facility criteria. Blank profiles will be obtained from the specific disposal facility that will be used. They will be completed to accurately characterize the waste. Waste profiles will be signed by the preparer.

Waste may be classified as RCRA hazardous, non-RCRA hazardous, or Class II non-hazardous, and transported via dump truck to the appropriate waste disposal facility as shown in Table 2. Liquid wastes will be profiled to verify compliance with the discharge permit for CERCLA contaminants for the onsite sanitary sewer treatment system. Non-compliant liquid waste will be disposed of off-site.

5.3 WASTE MANIFEST PACKAGE PREPARATION

The T&D Coordinator will prepare one manifest package for each waste stream. Each manifest package will be signed by a Navy representative.

Hazardous waste, if generated, transported from the site will be accompanied by a Hazardous Waste Manifest. The Navy representative will be responsible for reviewing and signing both the waste manifest and Land Disposal Restriction (LDR) notifications (manifest packages). Waste manifests will include the following: generator name and address, generator emergency response number, generator United States Environmental Protection Agency (USEPA) identification (ID), and analytical profiles. An LDR form will accompany any shipments of Resource Conservation and Recovery Act (RCRA) hazardous waste to the treatment, storage, and disposal facility (TSDF). The TSDF will be notified prior to the waste being sent.

Waste that is characterized as nonhazardous will be transported using a nonhazardous waste manifest, which will be reviewed and signed by the Navy representative. A copy of the manifest will be provided to the Navy. Copies of manifests for waste generated at the site will be maintained in the project files. Nonhazardous waste manifests will include the following: generator name and address, generator emergency response number, generator USEPA ID, and analytical profiles.

5.4 WASTE TRANSPORTATION AND DISPOSAL

All soil, liquid waste (generated primarily from excavation dewatering, well development, sampling, potential free product, and any decontamination), and debris (i.e., fence debris, asphalt, concrete, vegetative debris, building materials, PPE etc.) will be recycled or disposed offsite in accordance with federal, state and local regulations after being radiologically, ACM, and/or LBP cleared and approved as necessary. Disposal will occur once proper approval is received from the Navy representative and in accordance with acceptance requirements for the facility. Offsite transportation will be performed by a licensed contractor.

If hazardous waste is generated, it will be transported under United Stated Department of Transportation (DOT) hazardous material regulations. Hazardous waste off-site transportation will be in accordance with the DOT Hazardous Material Transportation regulations of 49 Code of Federal Regulations (CFR) Parts 171 through 177; 40 CFR Part 262, Subpart B; and 22 CCR Section 66262.

All trucks will need to pass through a radiological portal monitor as they enter and exit Site 12 and will need to be weighed and pass through another portal monitor at the disposal facility. Haul trucks, whether loaded or empty, will pass through a four-step radiological screening process prior to leaving an RCA or other controlled area. First, loose dirt and debris will be cleaned off the dovetail and bed rail of the truck. The truck will then drive over a rumble strip to knock off any clumps of soil that may have attached to the truck. The truck tires and dovetail will be inspected for loose material, radiologically surveyed, and power-washed, if needed. The truck will then pass through a radiation portal monitor for final confirmation of successful radiological screening. All truck’s will be tarped as well.

The portal monitor will be provided by the Navy. The weight of the truck at the disposal facility will be used to determine the reimbursement for disposal. All trucks leaving the site with excavated soil will be covered and the exterior of the vehicles and tires will be decontaminated. The truck weight at the disposal facility is intended to provide a basis for documenting the quantity of waste disposed of offsite.

Collected waste water will be filtered or otherwise treated and sampled to verify compliance permit and/or discharge requirements prior to discharge. If permission is granted from the City and County of San Francisco to discharge small quantities of wastewater to the on-site wastewater treatment plan, then drummed liquid waste will be disposed of on-site rather than being transported off-site. Water not suitable for discharge will be disposed as liquid waste.

Gilbane will obtain acceptance of liquid waste for disposal at the Treasure Island waste water treatment facility or utilize an appropriate offsite facility.

5.5 WASTE INSPECTION AND DOCUMENTATION PROGRAM

While waste accumulation areas will be informally inspected on a daily basis, formal inspections of accumulation areas will be conducted and recorded weekly at a minimum and documented. These inspections will also address any areas of concern at the time they are found. Daily inspections will be conducted for any containers or tanks containing hazardous waste. The Site Safety and Health Officer or designee will conduct inspections. Inspections will be logged in a bound, numbered field notebook. The container storage area will be inspected to ensure the following:

- Container labels and markings are present, complete, accurate, and legible.
- Containers are in good condition. If a container is not in good condition or appears to be leaking, the waste will be transferred to another container.
- Containers are made of materials that will not react with, and are otherwise compatible with, the hazardous waste to be stored.
- Containers are closed at all times, except when adding or removing waste.
- Containers are stored on-site less than 90 days.

6.0 MANAGEMENT OF RADIOACTIVE WASTES

Gilbane is responsible for radiological field surveys, screening and sampling performed within the Controlled Area of the construction site, in accordance with our broadscope Nuclear Regulatory Commission (NRC) license. Details of waste management for radioactive wastes can be found in the Radiological Management and Demolition Plan (RMDP) located in Appendix E of the Work Plan.

6.1 SOLID WASTE

Where possible, waste materials will be loaded into roll-off boxes, drums, or other appropriate containers at the point of generation. Radioactive/mixed wastes will be placed in bins provided by the Navy's LLRW contractor. An up-to-date inventory will be maintained of storage bins. A waste information fact sheet will be prepared for each radioactive object that is recovered to detail the analytical information about the source to include photographs of the source, radionuclide identification, estimated curie content, and radiological survey information.

6.2 LIQUID WASTE

As a general rule, remediation activities will be designed to avoid the use of significant quantities of liquids requiring treatment and/or disposal. Minimal use of water is anticipated for dust control activities; however, the generation of free water will be avoided. Accumulated water will be managed in a manner similar to storm water run-off. Water from dust control activities, purge water from groundwater sampling, and decontamination water is collected in drums. The water is filtered or otherwise treated and sampled to verify compliance with the discharge permit prior to discharge to the onsite sanitary sewer treatment system. Filters and sediment from water treatment will be handled as solid waste.

7.0 RELEASE PREVENTION, RESPONSE AND REPORTING

Release prevention, response, and reporting are discussed in this section.

7.1 SPILL PREVENTION

The primary activities that may result in a spill include vehicle fueling and management of decontamination waste. Spill prevention practices for these activities are as follows:

- Fueling — Vehicles will be fueled and serviced prior to moving onto the site. Any on-site fueling of equipment will be conducted within a designated and controlled area. Bulk quantities of fuel may be stored on site. Gilbane will notify the Remedial Project Manager (RPM), Resident Officer in Charge of Construction (ROICC), and CSO prior to storing fuel to ensure that the Navy is given the appropriate amount of time in order to comply with any regulatory requirements, such as a Spill Prevention Control and Countermeasure Plan.
- Wastewater — If generated, wastewater will be stored in containers or tanks and will be contained and will not be released to the surrounding areas.

7.2 SPILL RESPONSE

Gilbane personnel are trained to contain and control minor spills of petroleum and hazardous substances. In the event of a release of hazardous materials into the environment, Gilbane will contain or control the release or evacuate the area if the spill is significant or represents an immediate health threat. Spills and leaks involving NSTI will be reported to the RPM, ROICC, and CSO. A hazardous materials spill kit, including an 85-gallon polyethylene overpack, clay absorbent, spill booms, absorbent pads, and shovels, will be kept readily available at the work site. Cleanup of minor spills will be initiated immediately following the occurrence of a spill event.

7.2.1 Minor Spill

The main goal of a response to a minor spill at the site is to contain the spread of the spill. The following procedures will be implemented by on-site personnel if a minor spill occurs:

- If the spill occurs on paved or impermeable surfaces, clean up using “dry” methods (i.e., absorbent pads, clay absorbent, and rags).
- If the spill occurs in unpaved or exposed soil areas, contain the spill by constructing an earthen dike. Dig up the affected soil and place in soil stockpile for disposal.
- If the spill occurs during rain, cover the affected area to avoid runoff.
- Record steps taken to report and contain the spill.

7.2.2 Major Spill

If a major spill occurs, personnel will contact the local fire department. Appropriate personnel will initiate emergency response notifications.

7.2.3 Spill/Release Reporting

Precautions will be taken to prevent hazardous material spills. Informal daily inspections of equipment, structure(s), and containers will be conducted by site personnel. In addition, personnel using hazardous materials will inspect containers before and after use. In the event of a spill/release, the Site Superintendent will notify the Gilbane Project Manager and spill response will be conducted in accordance with the HSP; federal, state, and local regulations; and Navy policies and procedures.

The steps below outline the chain of communications that will be followed if a significant spill of any hazardous substance occurs. A significant spill will be considered any spill over the reportable quantity, as determinable by federal and/or state regulations, as well as any spill below the reportable quantity that is not properly contained and is released to the environment.

1. Site personnel involved in the spill will immediately contact the Site Superintendent or SSHO, who will notify the Gilbane Project Manager. At least one of the following two individuals will be on site during all remedial activities:

   - Site Superintendent: Tony Olmstead – 925- 250-7875
   - SSHO: Teresa Ruha – 925- 525-8210

   The Site Superintendent or alternate will contact the Remedial Project Manager, ROICC, and CSO identified as follows:

   - Contracting Officer’s Representative: Leo Larson – 619-524-5257
   - ROICC: Izzat Amadea – 510-333-3889
   - CSO: Glen Ivey – 415-743-4729

2. If a release of a waste of hazardous substance, regardless of quantity, could threaten human health or the environment outside the facility, the Gilbane Project Manager will verify that the National Response Center (800.424.8802) and the local Emergency Response Coordinator (Fire Department) have been notified by the Navy. Releases will be reported, and written follow-up emergency notices will be submitted under the Superfund Amendments and Reauthorization Act of 1986, Title II requirements.

8.0 UPDATING THE WASTE MANAGEMENT PLAN

This WMP will be updated as changes in site activities or changes in applicable regulations occur.

9.0 REFERENCES

California Code of Regulation, Title 22, Social Security, Division 4.5, “Environmental Health Standards for the Management of Hazardous Waste,” Chapter 12, “Standards Applicable to Generators of Hazardous Waste,” current through April 10, 2009.

TABLES

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Table 1: Waste Accumulation Methods and Times

Waste	Accumulation Method	Maximum Accumulation Times*
Soil. Class 1 (hazardous) contaminated with semivolatile organic compounds, dioxins, and/or heavy meatals	Temporary waste pile; roll-off container	90 days maximum
Soil. Class 2 (nonhazardous, no regulated contaminants)	Temporary waste pile; roll-off container	Not applicable for nonhazardous; 90 days maximum for hazardous
PPE	Roll-of container; plastic bag	Not applicable for nonhazardous; 90 days maximum for hazardous
Construction debris (metal, wood, plastic, paper, etc.)	Temporary waste pile; roll-off container	Not applicable for nonhazardous; 90 days maximum for hazardous
Concrete chunks (from demolition of sidewalk, walkways, etc.)	Temporary waste pile; roll-off container	Not applicable for nonhazardous; 90 days maximum for hazardous
Asphalt chunks (from demolition of roadway)	Temporary waste pile; roll-off container	Not applicable for nonhazardous; 90 days maximum for hazardous
Wastewater (from equipment decontamination, stormwater and/or dewater of excavations)	Temporary storage tank	Not applicable for nonhazardous; 90 days maximum for hazardous

*California Code of Regulations (CCR), Title 22, Social Security; Division 4.5, Environmental Health Standards for Management of Hazardous Waste; Chapter 12, Standard Applicable to Generators of Hazardous Waste; current through April 10, 2009.

Table 2: T&D Facility Selection

Classification and Waste Profile for Disposal	Permitted Disposal Facility
Soil is nonhazardous by RCRA, but hazardous by CA Standards (Cal Haz)	• RCRA landfill, Buttonwillow, CA (Clean Harbors • Rail to EC/DC, Clive, Utah
Soil is nonhazardous containing TPH (Class II)	Keller Canyon Class II landfill, Baypoint, CA (Republic)
Construction Debris and Green Waste	Ox Mountain Landfill, Half Moon Bay, CA (Republic)
Liquid Waste	Small quantities anticipated; drum disposal to EBMUD (upon approval)

ATTACHMENTS

ATTACHMENT 1: WASTE INVENTORY LOG

WASTE INVENTORY LOG

Gilbane Federal
Contract No. N62473-17-D-0005; Contract Task Order F4239
Former Naval Station Treasure Island
San Francisco, California

Date of Inventory Inspection: ________________ Inspected by: ______________________

Container Number	Container Type	Container Volume	Generation Date	Waste Description	Date Removed from Site

ATTACHMENT 2: WASTE STORAGE AREA INSPECTION CHECKLIST

WASTE STORAGE AREA INSPECTION CHECKLIST

Inspected by: __________________________ Date: _________________ Time: _____________

	Yes	No	Correction Action	Date Corrected
Area posted with appropriate hazard and cautionary signs?				
Area free of spills?				
All liquids stored in proper secondary containment?				
Secondary containment basins free of liquids and debris?				
Containers compatible with waste being stored?				
Containers properly sealed (lids on, rings in place, bins covered, etc.)?				
Containers properly labelled?				
Labels easily visible for inspection?				
Accumulation start date present on labels?				
Accumulation start dates with storage time limit (e.g. 90 days)?				
Information on labels legible not faded, and all required information is present?				
Adequate aisle space for drums (minimum 22 inches)?				
Aisles and doorways free of obstructions?				
Containers free of leaks, dents, or deterioration including structural defects and rusting?				
Adequate separation of incompatible materials?				
Tops of containers free of standing water?				
Notes:				

APPENDIX C

TRAFFIC CONTROL PLAN

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Naval Facilities Engineering Command Southwest
BRAC PMO West
San Diego, CA

FINAL
REMEDIAL ACTION/NON-TIME CRITICAL REMOVAL ACTION TRAFFIC CONTROL PLAN

Installation Restoration Site 12

Report and Figure 1

Former Naval Station Treasure Island, San Francisco, CA

September 2018

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Naval Facilities Engineering Command Southwest
BRAC PMO West
San Diego, CA

FINAL
REMEDIAL ACTION/NON-TIME CRITICAL REMOVAL ACTION TRAFFIC CONTROL PLAN

Installation Restoration Site 12

Report and Figure 1

Former Naval Station Treasure Island, San Francisco, CA

September 2018

Prepared for:

Department of the Navy
Naval Facilities Engineering Command Southwest
1220 Pacific Highway
San Diego, CA 92132

Prepared by:

GILBANE FEDERAL
1655 Grant Street, Suite 1200
Concord, CA 94520

Contract Number: N62473-17-D-0005; Task Order: N6247317F4239

DCN: GLBN-0005-4239-0011

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

bcy	bank cubic yards
DOT	California Department of Transportation
Gilbane	Gilbane Federal
IR	Installation Restoration
LLRO	low-level radioactive objects
LLRW	low-level radioactive waste
mph	miles per hour
MUTCD	Manual of Uniform Traffic Control Devices
NAVSTA TI	Naval Station Treasure Island
NSTI	Naval Station Treasure Island
NTCRA	non-time critical removal action
RMDP	Radiological Management and Demolition Plan
RSO	Radiation Safety Officer
RSY	radiological screening yard
SWDA	solid waste disposal areas
TCP	Traffic Control Plan

1.0 INTRODUCTION

This Traffic Control Plan (TCP) was prepared by Gilbane Federal (Gilbane) in fulfillment of the work scope of Contract Number N62473-17-D-0005, Task Order F4239. This plan is included as Appendix C to the Remedial Action / non-time critical removal action (NTCRA) Work Plan prepared for the remedial action activities to be performed in the non-Solid Waste Disposal Areas (SWDA) within Installation Restoration (IR) Site 12 (Old Bunker Area) and to continue the IR Site 12 NTCRA at the Northpoint SWDA at the former Naval Station Treasure Island (NSTI) in San Francisco, California (refer to Figure 1 in the Remedial / NTCRA Work Plan).

1.1 GENERAL APPROACH

The TCP includes details regarding road closures and other traffic controls to be in effect during remediation activities. This plan includes provisions and notifications of:

- road closures and/or closures within residential parking areas;
- identification of approved truck routes, holding, and queuing areas;
- controlling traffic near the project site (if necessary); and
- site preparation and provisions for use of access roads (signage, barricades, signals, flagman, and/or other methods will be utilized to minimize the impact on daily activities of the Treasure Island community).

Work at IR Site 12 includes the following activities that may impact the surface traffic patterns on California Avenue, Avenue H and M, 13th Street, Halyburton Court and Gateview Avenue. Traffic control devices, location and operations will be in accordance with the Manual on Uniform Traffic Control Devices for Streets and Highways (California Department of Transportation [DOT], 2014) and Caltrans Temporary Traffic Control Manual. This TCP was developed to assure the safety and convenience of motorists, pedestrians, and workers during construction. Current traffic activity in these areas of NSTI is moderate and construction activities at IR Site 12 will have minimal impact on any existing NSTI traffic. NSTI is currently a residential area and open to the general public.

Proper planning and scheduling of work will be implemented in order to reduce any potential impacts to traffic flow, with soil hauling activities scheduled to avoid early morning and late afternoon “rush hour” traffic flows on NSTI. The existing traffic control measures will be utilized to reduce the effects of inbound and outbound soil hauling vehicles.

1.2 THE CALIFORNIA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD)

Although not required, the following are the MUTCD (State of California DOT, 2014) principles most applicable to work on NSTI; these principles will be utilized as guidance during implementation of any supplemental traffic control measures:

MUTCD, Part 6, Temporary Traffic Control

- Chapter 6A: General Information
- MUTCD, Part 6, Temporary Traffic Control, Chapter 6B, Fundamental Principles
- MUTCD, Part 6, Temporary Traffic Control, Chapter 6E: Flagger Control
- MUTCD, Part 6, Temporary Traffic Control, Chapter 6F: Temporary Traffic Control Zone Devices

2.0 SITE SPECIFIC APPROACH

The majority of the residential buildings within the immediate vicinity of IR Site 12 are vacant and the area is currently enclosed by perimeter fencing. The residences at Buildings 1126 and 1217 have been vacated to accommodate intrusive activities. Barricades with flashing lights, flags, signs, flag persons, and other traffic control measures will be used as needed, to inform the general public of lane closures and to direct trucks entering the roadway. Traffic control barricades and signs will comply with California DOT specifications.

Traffic control will not be necessary on the Bay Bridge to accommodate waste transport as no disruption of Bay Bridge traffic due to the truck traffic is expected during remediation activities.

2.1 IMPACTED TRAFFIC AREAS

The following activities may impact traffic to and from staging laydown areas in IR Site 12 and the soil radiological screening yard (RSY) in Site 6 and Site 32 (shown on Figure 1):

- Loading and transporting an estimated total of 8,000 bank cubic yards (bcy) of low-level radioactive waste (LLRW) soil from the RSY area in Site 6 and Site 32 to the approved waste disposal facility. An estimated 4,000 bcy will be staged at the RSY and the other 4,000 bcy will be transported from IR Site 12 to the RSY, and then transported to the waste disposal facility.

- Loading and transporting of low-level radioactive objects (LLRO) from IR Site 12 to the RSY and then to the approved waste disposal facility.
- Loading and transporting demolition debris from existing Buildings 1126 and 1217. Material from the buildings will be radiologically scanned in accordance with the Radiological Management and Demolition Plan (RMDP). Once the building material debris is free released, it will be suitable for disposal in a landfill.
- Removal of building demolition debris (wood, plaster, etc.)
- Removal of construction debris (concrete foundations, drive ways, asphalt)
- Removal of asbestos containing materials and/or lead based paint from remediation of buildings
- Delivery of materials
- Mobilization/demobilization of subcontractors (i.e., asbestos abatement, utility clearance, land surveying, portable toilets and fencing) and heavy equipment (i.e., excavators, loaders, and dump trucks)
- Operating of Gilbane vehicles between IR Site 12 and RSY and Building 570, Gilbane Site Office.

Traffic routes to IR Site 12, RSY and Gilbane field trailer are shown on Figure 1.

2.2 TRAFFIC CONTROL NOTIFICATIONS

Gilbane will notify the Navy at least 24 hours before large shipments or deliveries are expected on the jobsite and notify the Navy and the Project/Site Radiation Safety Officer (RSO) by email or telephone of any construction activities that will alter traffic flow.

If it becomes necessary to modify the vehicular patterns described herein during the performance of the remediation activities, Gilbane will notify:

- The San Francisco Fire Department—NSTI
- The San Francisco Police Department—NSTI
- The Treasure Island Development Agency

before the implementation of the proposed modification.

2.3 TRAFFIC ROUTES

Following is a description of the haul route to be used by trucks entering and leaving the jobsite. Trucks will exit the Highway 80 freeway and enter onto Treasure Island Road, then will turn right onto California Avenue.

2.3.1 Access to the Radiological Screeing Yard (RSY)

To access the RSY area from California Avenue, trucks will turn left onto Avenue M. The RSY area is located at the corner of Avenue M and 14th Street. The RSY area is outside IR Site 12 and the residential area. Specific planned truck haul routes between the IR Site 12 work sites and RSY areas are shown in the RDMP. Generally, trucks hauling impacted soil following excavation to the RSY pads will travel along Avenue M. Metal plates and/or wooden planks will be used to protect existing paved roads from track damage when entering into the RSY area. During the project, part of Perimeter Road will be maintained as a private access road and use by the general public will be restricted. If part of Perimeter Road cannot be completely fenced in, radiological controls and waste manifesting will be implemented.

2.3.2 Access to Building Debris Area

To access the building debris area from California Avenue, trucks will turn left onto Avenue H which becomes Gateview Avenue. Once trucks cross over 13th Street, trucks will be in the residential area. During the project, the building debris area will be maintained as a controlled fenced-in area.

2.4 TRAFFIC EXITING

Before trucks are able to drive offsite, they must pass through the Portal Monitor. The Portal Monitor is managed by a Navy contractor and Gilbane will coordinate with them on when access to the Portal will be needed. The Portal Monitor is a second form of radiological screening to ensure safe transportation of material onto public roadways.

Transport of heavy dump trucks will be limited to 8:00 am to 5:00 pm during business days.

3.0 REFERENCES

California Department of Transportation, 2014, *California Manual on Uniform Traffic Control Devices (MUTCD) for Streets and Highways, Federal Highway Administration's [FHWA's] MUTCD 2009 Edition, including Revisions 1&2 as Amended for Use in California*.

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FIGURES

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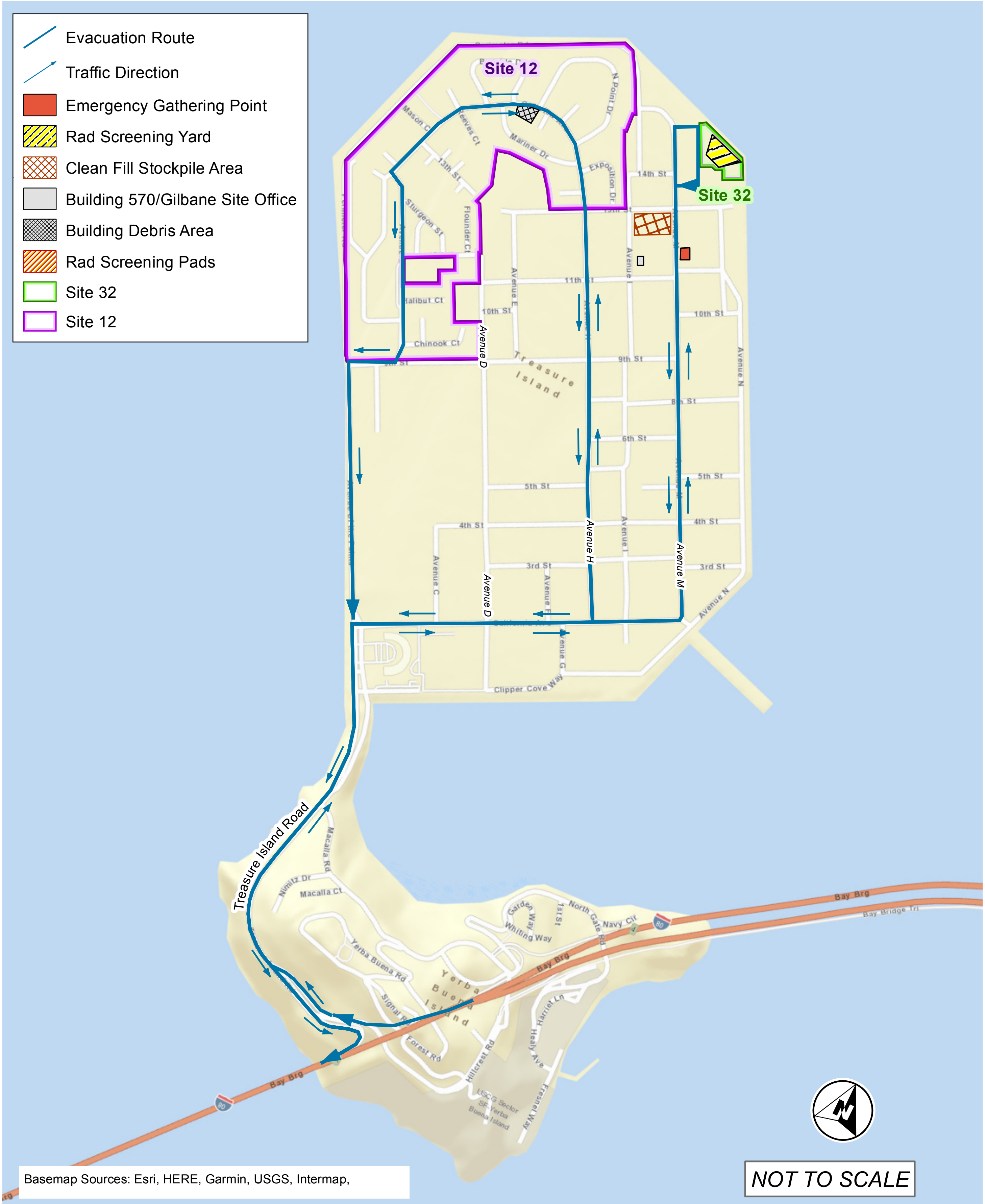

NAVFAC Naval Facilities Engineering Command

IR Site 12 Non-SWDA Remedial Action/
SWDA Removal Action
Former Naval Station Treasure Island
San Francisco, CA

Figure 1
IR Site 12
Truck Route Map

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APPENDIX D

CONTRACTOR QUALITY CONTROL PLAN

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Naval Facilities Engineering Command Southwest
BRAC PMO West
San Diego, CA

FINAL
REMEDIAL ACTION/NON-TIME CRITICAL REMOVAL ACTION CONTRACTOR QUALITY CONTROL PLAN

Installation Restoration Site 12

Report, Table 1, Figures 1 and 2 and Attachments 1, 2 and 3

Former Naval Station Treasure Island, San Francisco, CA

September 2018

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BRAC PMO West
San Diego, CA

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REMEDIAL ACTION/NON-TIME CRITICAL REMOVAL ACTION CONTRACTOR QUALITY CONTROL PLAN

Installation Restoration Site 12

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Former Naval Station Treasure Island, San Francisco, CA

September 2018

Prepared for:

Department of the Navy
Naval Facilities Engineering Command Southwest
1220 Pacific Highway
San Diego, CA 92132

Prepared by:

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Contract Number: N62473-17-D-0005; Task Order: N6247317F4239

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

LIST OF ACRONYMS AND ABBREVIATIONS

APP	Accident Prevention Plan
AHA	Activity Hazard Analysis
bgs	below ground surface
CO	Contracting Officer
CQC	Contractor Quality Control
CQCP	Contractor Quality Control Plan
CSO	Caretaker Site Office
CTO	Contract Task Order
DFOW	definable feature of work
EPM	Environmental Protection Manager
Gilbane	Gilbane Federal Company
HRASTM	Historical Radiological Assessment Supplemental Technical Memorandum
IR	Installation Restoration
Navy	United States Department of the Navy
NAVFAC	Naval Facilities Engineering Command Southwest
NSTI	former Naval Station Treasure Island
NTCRA	non-Time Critical Removal Action
PM	Project Manager
PQCM	Project Quality Control Manager
QA	Quality Assurance
QC	Quality Control
RAOs	remedial action objectives
RASO	Radiological Affairs Support Office
RAWP	Remedial Action Work Plan
RFIs	Request for Information
RGs	remediation goals
ROICC	Resident Officer in Charge of Construction
RPM	Remedial Project Manager
RSO	Radiation Safety Officer
SAP	Sampling and Analysis Plan
SOW	Statement of Work
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
SWDA	Solid Waste Disposal Areas
UFGS	Unified Facilities Guide Specifications
USACE	U.S. Army Corps of Engineers

1.0 INTRODUCTION

Gilbane Federal (Gilbane) has prepared this Contractor Quality Control Plan (CQCP) as Appendix D to the Remedial Action/NTCRA Work Plan (RAWP), under Contract Number N62473-17-D-0005, Contract Task Order (CTO) F4239. This CQCP describes the Quality Control (QC) actions and procedures that will be followed during the activities that will be performed within Installation Restoration (IR) Site 12 Old Bunker Area and to continue into IR Site 12 non-Time Critical Removal Action (NTCRA) at the Solid Waste Disposal Areas (SWDA) at former Naval Station Treasure Island (NSTI) in San Francisco, California.

IR Site 12 is radiologically impacted, as documented in the *Historical Radiological Assessment Supplemental Technical Memorandum* (HRASTM). Therefore, this CQCP will also include radiological controls, surveying, screening, potential object retrieval, characterization, and sampling to ensure worker(s) and community health and safety within the project area footprint(s). In conjunction with these activities, the requirement to prepare a radiological data package for a radiological characterization survey will be fulfilled. The CQCP includes a description of the QC organization, roles and responsibilities, a submittal register, reporting procedures, and a list of definable features of work (DFOW). The CQCP follows the three phases of control for each DFOW.

The primary function of CQCP is to assure the completed project meets all quality requirements of the contract. Government Quality Assurance (QA) will be conducted during the field effort through reviews and inspections by designated representatives. The CQCP meets the requirements of the current version of Unified Facilities Guide Specifications (01 45 00.00 20 dated November 2011) for QC and includes:

- a description of the QC organization, including a chart showing lines of authority;
- the names, qualifications, duties, authorities, and responsibilities of each person assigned a QC function;
- a description of onsite and offsite work as well as the work sequence; a schedule for managing submittals, testing, inspections, QA audits, meetings, three phases of control, and any other QA function (including contractors, subcontractors, fabricators, suppliers, purchasing agents, etc. that are involved in assuring quality workmanship, verifying compliance with the plans and specifications, or any other QC objectives);

- a description of how the remediation activities comply with environmental requirements including air quality, emissions monitoring records, waste disposal records, etc.;
- reporting procedures and reporting format for CQCP activities including such items as daily summary reports, schedule of data submissions, inspection data sheets, results of QA fieldwork audits, problem identification and corrective measures reports, evaluation reports, acceptance reports, and final documentation; and
- a list of DFOWs to be performed separate and distinct from other tasks with separate control requirements.

This project-specific CQCP was developed to ensure that project activities are conducted in a planned and controlled manner; that the product of these activities conforms to Contract requirements; and that appropriate documentation exists to support each activity for which Gilbane is responsible.

A Site Superintendent/Field Team Leader and Project Quality Control Manager (PQCM) will be present on site during field activities, and will oversee and supervise work performed by Gilbane personnel and subcontractors on the project. The PQCM, who reports directly to the QC Program Manager, will work closely with the Project Manager (PM) and Project Scientist, and with the United States Department of the Navy (Navy) QC representatives, to assure that the work is performed in compliance with the specifications contained in the approved RAWP and this CQCP. The PQCM has the authority to stop work if Contract requirements are not being met. In the event that the PQCM is unavailable, an alternate PQCM will assume this responsibility. The proposed QC organization for this project is shown on Figure 1, which includes relationships to other elements of Gilbane Company, including the reporting structure to a corporate officer. The details of the project QC organization, including qualifications and responsibilities of key QC personnel, are outlined in Section 2 and presented on Figure 1.

The QC Program Manager for this Navy Contract is responsible for implementing the quality control program for the Contract, and will work directly with the PM and PQCM to assure that all work is performed in compliance with the Contract. The QC Program Manager will serve as an alternate contact for the PQCM if questions arise regarding acceptability of materials or performance during the project.

The PM reports to the Program Manager for the Contract, who has the responsibility and authority to insure that the work is performed according to the approved specifications and to the

Navy’s satisfaction. The QC Program Manager is also the Corporate QA/QC Director, who reports directly to the Executive Vice President. The QC Program manager is responsible for reviewing the CQCP as needed and for verifying compliance with contract documents and the applicable QA/QC requirements.

2.0 QUALITY CONTROL ORGANIZATION

Gilbane has structured its corporate QC organization to support the Program and Project Managers who have ultimate responsibility for the quality of services Gilbane provides. The Program and Project Managers are responsible for ensuring that personnel in their organizations understand the corporate and contract-specific QC programs and that their organizations' functions are set up and maintained effectively.

Quality issues are resolved at the lowest possible organizational level at each project site, to enable timely corrective action development and implementation. Issues that cannot be satisfactorily resolved at the project level are elevated to and resolved at the corporate level.

Key staff positions in the Gilbane QC organization for each project conducted under this Contract include:

- Corporate QA/QC Director / QC Program Manager
- Program Manager
- Project QC Manager
- Alternate QC Manager
- Project Manager
- Radiation Supervisor Officer

The project organization chart, including QC personnel, is shown on Figure 1 of this CQCP. This figure illustrates the reporting and communication relationships between QC personnel, the Gilbane field team, subcontractors, and Navy representatives. This structure provides the organizational freedom for personnel to identify and evaluate quality problems and discrepancies, provide recommended solutions, and ensure that appropriate corrective actions are taken.

The specific responsibilities and qualifications associated with each QC-related position are outlined in Table 1. The qualifications and experience of the proposed key appointees for this project are summarized in the following subsection. All QC organization personnel are subject to acceptance by the Contracting Officer (CO). The CO may require the removal of any individual for non-compliance with quality requirements specified in the Contract.

2.1 QC PERSONNEL AND QUALIFICATIONS

Key QC personnel for Gilbane projects are assigned on the basis of appropriate experience and the determination that these individuals meet all CTO specific requirements. The PQCM and Alternate PQCM are appointed by the Corporate QA/QC Director. QC Specialists are appointed by the PQCM in the field as needed. The following paragraphs identify the QC team for this CTO and highlight their qualifications. As appropriate, copies of appointees' resumes and/or certifications are included in Attachment 1 to this QC Plan.

Corporate QA/QC Director / QC Program Manager

The Gilbane QA/QC director, Ms. Cheryl Prince, has 30 years of experience in QA and QC. She has developed and managed QA/QC programs at project, program, and corporate divisional levels, and has had oversight responsibility for multiple large Department of Defense contracts. Ms. Prince is responsible for audits and general oversight of project QC compliance, for the approval of PQCM designees, for providing guidance and support to Project QC personnel, and assisting with resolution of QC issues that cannot be resolved at the project or program level. Ms. Prince reports directly to the Executive Vice President of Gilbane. She also serves as the QC Program Manager for this contract.

Program Manager

The Program Manager, Mr. Arvind Acharya, has 26 years of experience managing environmental and remediation projects. He has performed over 35 Navy task orders involving remedial and removal actions, expedited response, and operations and maintenance. In his capacity as program manager, he ensures effective execution of projects and compliance with the Contract and with applicable regulatory program regulations, and their state and local counterparts. He has served as technical manager for five Navy programs, which involved multiple task orders at multiple sites that were implemented concurrently. His remediation experience covers a wide range of contaminants, including solvents, petroleum, metals, acids, bases, reactives, pesticides, ordnance waste, and unexploded ordnance.

Project Quality Control Manager

The PQCM assigned to this project is Mrs. Teresa Ruha. The PQCM, who reports directly to the QC Program Manager will work closely with the PM, Radiation Safety Officer (RSO), and Navy

QC representatives to assure that the work is performed in compliance with the specifications contained in the approved RAWP. The PQCM has the authority to stop work if Contract requirements are not being met. The PQCM's responsibilities are listed in Table 1. In the event the PQCM is unavailable, an alternate PQCM will assume this responsibility.

Copies of the PQCM's resume, letter of appointment, and current U.S. Army Corps of Engineers (USACE) QC certificate are included in Attachment 1.

Alternate Project Quality Control Manager

In the event the PQCM is unavailable, the Alternate PQCM will assume the QC responsibilities outlined in Table 1 and described in this CQCP. The alternate PQCM for this project is Mr. Brian Dee. Copies of Mr. Dee's resume, letter of appointment, and current USACE QC certificate are in Attachment 1.

Project Manager

The Gilbane Project Manager for this CTO, Mr. John Baur, has more than 30 years of experience in environmental investigation and remediation projects for the government, and over the past 10 years has managed four radiological projects at Treasure Island and Hunter's Point Shipyard. The Project Manager's responsibilities include developing task requirements with technical representatives, implementing project plans within schedule and budget, recommending and justifying change orders, tracking resources, monitoring and controlling costs, and ensuring compliance with safety and regulatory requirements.

Site Supervisor

The Site Supervisor, Tony Olmstead, and Chris Bryson (Radiation Safety Officer) will be present on site during field activities, and will supervise and oversee the quality of work performed by Gilbane personnel and subcontractors on the project. They will work closely with the PM and Project QC Manager, and will routinely communicate and coordinate directly with the Resident Officer in Charge of Construction (ROICC), as well as the Caretaker Site Office (CSO), to assure that work is performed in conformance with applicable requirements and to the satisfaction of the Navy. The Site Supervisor's responsibilities are listed in Table 1.

3.0 OUTSIDE ORGANIZATIONS

To manage subcontractors and vendors effectively, Gilbane carefully selects and prequalifies each firm. Gilbane continuously and aggressively manages subcontractor costs, schedule, safety, and quality performance. The pre-qualification process ensures that subcontractors bring the same focus on quality, cost control, schedule discipline, and commitment to customer satisfaction as Gilbane. Once an award is made to a subcontractor, Gilbane manages the quality of the subcontractor's performance through the three-phase inspection process outlined in Section 9.0.

Laboratories providing environmental analyses are accredited by a program identified in Unified Facilities Guide Specifications (UFGS) 01 45 02, Section 1.13.2 Laboratory Accreditation Authorities, as appropriate.

The subcontractors/laboratories expected to provide products and services to Gilbane during the performance of the field activities of this Task Order include:

- TestAmerica Laboratory of St. Louis, Missouri, will provide laboratory services for testing of all radiological survey materials samples (radiological analysis related aspects of the project are discussed in the Sampling and Analysis Plan [SAP], Appendix A of the RAWP).
- Hertz Equipment Rental of Pacheco, California will provide site vehicle rental services.
- Envirachem – Radiological Safety Lab (Smear sample analysis).

Names and qualifications of all subcontractors proposed for this project and not identified above will be submitted to the Navy for review and approval prior to the start of field activities. All subcontractors will be subject to Gilbane's QC procedures, and will be provided with copies of the approved CQCP. Testing and inspection procedures will be monitored by Gilbane as described in Section 5.0 of this plan.

4.0 SUBMITTAL PROCEDURES

During the implementation of this CTO, subcontractors and vendors will be required to submit drawings and data to Gilbane for approval. All submittals will be reviewed and certified by the PQCM or RSO before they are forwarded to the Navy.

The procedure for internal Gilbane approval of these submittals is as follows:

- As applicable, the subcontractor or vendor will provide relevant drawings, survey data, and test results to the RSO for review.
- The RSO will verify that the information is complete and that the survey methods and data are consistent with the requirements of the applicable sections and/or appendices of the RAWP.
- Each documentation package will be submitted with a transmittal form that identifies the contract number, task order number, location, and description of the submitted information. The submittal will carry the approval of the RSO indicating his review and approval of the package as meeting contract requirements.

5.0 SPECIAL INSPECTION AND TESTING

In addition to implementing the three phases of control system to ensure the overall quality of each DFOW, Gilbane will make use of formal testing and inspection procedures where applicable–including tests performed by subcontractors and/or off-site laboratories–to ensure conformance to applicable specifications and verify that control measures are adequate to provide a finished product which conforms to Contract requirements.

5.1 SPECIAL INSPECTION AND TESTING PLAN AND LOG

Inspections and tests will be performed during field work as part of the overall QC activities and as required by the applicable technical specifications. Applicable requirements will be detailed on a Special Inspection and Testing Plan and Log. The log will include the tests or inspections required, referenced by the specification paragraph number requiring the test, location where tests were taken, the frequency of the each, the person responsible for each, and the sequential control number identifying the test. All tests and inspections will also be noted on the Daily Activity Report and QC Report. (NOTE: Sampling and analysis associated with surveying and disposal are described in the SAP [Appendix A to the RAWP]. The Special Inspection and Testing Plan and Log will be prepared following final approval of the list of DFOWs for the project. A copy of the form is included in Attachment 3.)

Gilbane will provide the Navy with 24-hour notification prior to testing. The Gilbane PQCM will be on site during any testing activities and will document tests and areas of testing. The PQCM will also verify that the third-party testing agency provides adequate and certified equipment to be used during any testing activity. Upon request, Gilbane will furnish duplicate samples of test specimens for possible testing by the government or State of California. Testing includes operation and/or acceptance tests when specified. Gilbane will perform the following activities and record and provide the following data:

- Verify that testing procedures comply with contract requirements.
- Verify that facilities and testing equipment are available and comply with testing standards.
- Check test instrument calibration data against certified standards.

- Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.

Results of all tests taken, both passing and failing tests, will be recorded on the daily QC Report for the date taken, as well as the Testing Plan and Log. If approved by the CO, actual test reports may be submitted later with a reference to the test number and date taken. An informational copy of tests performed by an off-site or commercial test facility will be provided directly to the CO.

The types of testing and methods of testing/inspection expected to be implemented for this project are outlined in the following subsection.

5.2 EQUIPMENT INSPECTIONS

Inspection requirements are outlined in the Site Safety and Health Plan (SSHP). The Site Safety and Health Officer (SSHO), PQCM, or designee will verify that equipment vendors and subcontractors provide safety equipment checklists with each piece of equipment used on the site. Operators using the equipment will also maintain daily inspection records of each piece of power equipment and machinery used on site. Equipment inspection forms are provided in the SSHP.

6.0 TRACKING DEFICIENCIES

The PQCM will review any instances where materials, equipment or activities fail to meet the specified requirements, and will take appropriate action to prevent future occurrences. All Gilbane and subcontractor personnel will be responsible for bringing potential non-conformances to the attention of the Site Superintendent or PQCM. Client complaints and requests for corrective action also will be documented and routed to the Project Manager or PQCM as appropriate.

6.1 DEFICIENCIES

A “deficiency” is defined as any item, part, product or activity with one or more characteristics that depart from the relevant specification, drawing, or other approved method of description, thus making the material, workmanship, or equipment potentially unfit for use. The PQCM will review these occurrences and take appropriate action to remediate these occurrences and prevent reoccurrence.

Most deficiencies can be corrected during the process of the work through the PQCM’s direct interaction with workers and prior to acceptance of the feature of work encompassing the deficiency. Those deficiencies will be tracked through the use of a Rework Item List. Items recorded on the Rework Items List will be assigned a sequential number. The notation in the list will include the location and a concise description of the deficiency, and will indicate the PQCM’s verification of the corrective action. (A copy of this form is included in Attachment 3).

6.2 NONCONFORMANCES

A deficiency will be categorized as a “nonconformance” when it affects any of the following:

- Health and safety.
- Performance, durability, and longevity.
- Reliability or maintainability.
- Appearance (when a factor).

A Nonconformance will be addressed in the following manner:

- The portion of work that is affected by the nonconformance will be stopped.

- The entity responsible for the work or item will be officially notified in writing of the nonconformance (see Nonconformance/Corrective Action Request form in Attachment 3).
- The responsible entity will determine causes and develop corrective and preventive actions.
- The PQCM and PM will review and, when acceptable, approve the proposed actions.
- The corrective actions will be implemented by the responsible entity and verified by the PQCM before the impacted work, other than corrective measures, resumes.

Poor performance by subcontractors or suppliers will be documented and reported to procurement, and may result in termination of an individual's or company's services.

6.3 CORRECTIVE AND PREVENTIVE ACTION

The extent of corrective or preventive action taken will be commensurate with the magnitude of the condition and the associated risk factor(s). Corrective and preventive actions will be based on thorough examination of root causes.

After identification and correction of each deficiency, verification inspections will be performed as appropriate to verify the completion of the actions and access the effectiveness of the corrective/preventive measures implemented.

6.4 PROCEDURES FOR TRACKING LABORATORY DEFICIENCIES

Laboratory testing requirements for radiological analyses, and procedures for identifying and managing any deficiencies, are addressed under the SAP (Appendix A of the RAWP) for this project.

7.0 QUALITY CONTROL RECORDS AND DOCUMENTS

A variety of documents and certifications will be developed at specified points or intervals during the course of the project to support the quality control process. These items will be submitted to the Government or maintained by Gilbane and available for review, as required. QC-related project documentation may include:

- Testing Plan and Log.
- Daily Contractor QC Reports.
- Three Phase Control Inspection Checklists (Preparatory, Initial, and Follow-up).
- QC Meeting Minutes.
- Rework Items List.
- Nonconformance/Corrective Action Reports.
- As-Built Drawings.
- Material Receipt Inspections.

The following subsections briefly describe the elements of QC documentation that are not discussed in separate sections of this CQCP. Copies of the referenced QC forms are included in Attachment 3.

7.1 DAILY REPORTS

A Daily Radiological and Field Report and QC Report will be prepared for each day that work is performed at the site, and will account for each calendar day throughout the life of the contract.

The Daily QC Reports and Production Reports will be completed and signed by the PQCM or his or her designee and will be submitted to the Navy ROICC by 10:00 a.m. the following work day. Copies of the QC Reports and Daily Production Reports will be forwarded to the PM at the end of each work week.

Typically, the daily QC Report will include the following information:

- Preparatory or Initial Phase meetings and inspections performed with completed checklists provided as attachments.
- Follow-up inspections performed on ongoing DFOWs.
- Any tests, inspections, or other QC activities performed, with results and references to specifications/drawings or other requirements with test and inspection results provided as attachments.
- Deficiencies identified or corrected that day.

Each QC Specialist on the project will prepare a report for each day that work is performed in his or her area of responsibility. These reports will include the same documentation requirements as the QC Report for the applicable area of responsibility. QC Specialist reports will be signed and dated by the QC Specialists and attached to the QC Report prepared for the same day.

7.2 QC MEETING MINUTES

After the start of construction, the PQCM will conduct weekly QC meetings by conference call with the Site Superintendent, QC Specialists, and the foremen who are performing the work on the current DFOWs. The Navy Remedial Project Manager (RPM), NSTI CSO, ROICC, and the Radiological Affairs Support Office (RASO) Environmental Protection Manager (EPM) are designated to also attend these meetings.

As a minimum, the following will be accomplished at each QC meeting:

- Review the minutes of the previous meeting.
- Review the schedule and the status of work and rework.
- Review the status of submittals.
- Review the work to be accomplished in the next two weeks and documentation required.
- Resolve QC and production problems [pending Request for Information (RFIs), etc.].
- Address items that may require revising the CQCP.
- Review the Accident Prevention Plan (APP) and/or Activity Hazard Analysis (AHAs).
- Review environmental requirements and procedures.
- Review the following, as applicable: Waste Management Plan, Environmental Protection Plan, Radiological Management and Demolition Plan, status of training completion; and progress.

The PQCM will prepare the minutes of the meetings and provide a copy to the CO within two working days after the meeting.

7.3 QUALITY CONTROL VALIDATION

The PQCM will establish and maintain a series of three ring binders or folders, divided and tabbed, containing the information listed below. These binders will be readily available to the client during all business hours.

- All completed Preparatory and Initial Phase Checklists, arranged by specification section.

- All milestone inspections, arranged by Activity Number.
- An up-to-date copy of the Testing and Special Inspection Plan and Log with supporting field test reports, arranged by specification section or DFOW.
- Copies of all contract modifications, arranged in numerical order, along with documentation that modified work was accomplished.
- An up-to-date copy of the Rework Items List.
- Copies of QC Meeting minutes, arranged by date.
- Up-to-date copies of all punch lists issued by the QC staff to the Contractor and Sub-Contractors and all punch lists issued by the Government.
- Other QC-related correspondence and notes, arranged by date.

7.4 AS-BUILTS

If required, the Gilbane Site Superintendent or PQCM will mark up the site drawings or specifications when deviations from these documents occur. These mark-ups will be used in preparing “as-built drawings” for submission at the end of the project. Upon completion of work, the PQCM will furnish a certificate attesting to the accuracy of the as-built drawings prior to submission to the CO. Survey data will be used to verify locations.

7.5 PHOTOGRAPHIC RECORD

Photographic documentation of project activities will be maintained for the duration of the project, using a digital camera in JPEG (or equivalent) format. All photographs will be noted in field logbooks or the daily production reports. Information recorded will include the nature of the picture, its location, the time of day, and other pertinent information. All images will be archived, and electronic copies will be provided to the Navy following completion of the project.

7.6 COMPLETION REPORT

Following completion of field activities and site restoration, the contractor will prepare Internal Draft, Draft, Draft Final, and Final versions of a completion report. The report will contain the following:

- Description of the field work and the results of analysis.
- A preliminary screening evaluation of the analytical results collected during field work.
- A discussion of the results that will include: interpretation of the survey results; an assessment of the data; a statement as to whether or not the objectives of the survey were met; descriptions of the uncertainties of the data collected; and other information required to support conclusions and recommendations.

- Conclusions and recommendations based on the technical evaluation of the data collected.

7.7 RECORDS MANAGEMENT

Project records will be managed and provided to the Government as required by the Deliverable Schedule Matrix in Section 7 of the CTO F4239 Statement of Work (SOW), the *Environmental Restoration Recording Keeping Program Manual, Appendix G* [Naval Facilities Engineering Command Southwest (NAVFAC, *year*)], Contractor Work Instructions, and *NAVFAC Environmental Work Instruction 4* (NAVFAC, *year*).

8.0 DEFINABLE FEATURES OF WORK

A DFOW is a representative portion of work that is separate and distinct from any other stage of work. Four definable features of work have been identified for this project, as outlined in the following subsections and further described in the RAWP. All activities associated with the project will be conducted in accordance with the RAWP and the SSHP for this project, which provide specific methods and requirements for implementation of the DFOWs.

8.1 DFOW 1: SITE 12 EXCAVATE 58 DISCRETE LOCATIONS

An approximate depth of four feet below ground surface (bgs) was assumed for the 58 discrete excavations; this depth is an estimate based on previous investigations. Soil shall be excavated from the remedial action excavations until the remedial action objectives (RAOs) and remediation goals (RGs) are met, which may be shallower or deeper than four feet bgs. The lateral and vertical extent of all excavations shall be extended until the RAOs/RGs have been achieved. When an excavation is completed to the proposed limits, post-excavation confirmation soil samples will be collected from the excavation bottom and the excavation sidewalls in accordance with Appendix A the SAP of the RAWP at the following frequencies:

- One discrete bottom sample will be collected from the excavation bottom, at every on a square grid of 10 feet by 10 feet.
- One sidewall sample will be collected for every 2 linear feet of sidewall.
- Additional samples will be collected from the excavation floor and sidewalls at suspect locations (e.g., visually discolored soil, highest gamma scan reading), if any.

If a bottom confirmation sample location is below groundwater or standing water, then the sample will be collected using either a hand auger or an excavator bucket, or equivalent. After the soil is pulled out of the water, the soil will be allowed to drain, and the wet outer layer of soil will be removed and the dryer soil inside will be collected as a sample.

8.2 DFOW 2: DEMOLITION OF BUILDINGS 1126 AND 1217

Radiological surveys of accessible areas using scintillation detectors, associated data logging, gamma scan surveys, gamma spectroscopy, sampling and laboratory analysis are included in this DFOW. Surveys will be conducted on Building 1126 (80 feet wide 170 feet long; four feet of soil beneath the building will be excavated) and Building 1217 (80 feet wide 130 feet long; four feet of soil beneath the building will be excavated). Buildings 1126 and 1217 are two story buildings within the residential area of Site 12. Surveys will be conducted in accordance with the Radiological Management and Demolition Plan (Appendix E) of the RAWP for this CTO.

8.3 DFOW 3: SITE 6 AND SITE 32, STOCKPILING OF SOIL AND RADIOLOGICALLY SCREENING LAYDOWN PADS

Gamma walkover radiological surveys of soil using scintillation detectors, associated data logging, gamma scan surveys, gamma spectroscopy and sampling and laboratory analysis are included in this DFOW. Surveys will be conducted in accordance with the Radiological Management and Demolition Plan (Appendix E) of the RAWP for this CTO.

8.4 DFOW 4: DEMOLITION OF BUILDINGS 1202 (OPTION AS NEEDED)

Building 1202 is on two story building within the boundary of Site 12. Similar to buildings 1126 and 1217, radiological surveys of accessible areas using scintillation detectors, associated data logging, gamma scan surveys, gamma spectroscopy, and sampling and laboratory analysis are included in this DFOW. Surveys will be conducted in accordance with the Radiological Management and Demolition Plan (Appendix E) of the RAWP for this CTO.

9.0 THREE PHASES OF CONTROL/DOCUMENTATION FOR INSPECTION

The PQCM will use the three-phase of control method for inspection during implementation of this project to ensure the quality of workmanship and results. Three phases of QC will be applied to each DFOW outlined in Section 8. Each of the three phases of control as described in this section, and other QC-related activities, will be documented on the appropriate forms, and noted on the daily QC Reports.

9.1 PHASE 1: PREPARATORY PHASE

A preparatory phase meeting will be held and an inspection performed before work begins on each definable feature of work, after all required plans, documents, and materials are approved or accepted, and copies of the plans and documents are at the work site.

The PQCM will notify the Navy at least 48 hours in advance of the preparatory phase meeting. At this meeting, the Gilbane PQCM and any QC Specialists involved with the DFOW will meet with the Navy's representative(s) and foremen or management representative for each subcontractor involved in the feature of work.

The preparatory phase meeting will include, but not be limited to, the following activities:

- Review applicable sections of the RAWP.
- Review established provisions for required control inspections and testing.
- Review testing procedures to be implemented during the DFOW.
- Examine the work area to assure that all required preliminary work has been completed and is in compliance with the RAWP.
- Examine required materials and equipment to assure that these items are on hand, conform to approved drawings or submitted data, and are properly stored.
- Review the appropriate AHA.
- Discuss procedures for controlling the quality of the work, including repetitive deficiencies.
- Verify that the portion of the plan for the work to be performed has been accepted by the Navy.

Each preparatory phase meeting will be recorded on the preparatory inspection checklist, and noted on the daily QC Report form.

9.2 PHASE 2: INITIAL PHASE

An initial phase inspection/meeting will be accomplished as work begins on each definable feature of work. The PQCM will notify the Navy a minimum of 24 hours prior to the initial phase meeting. Initial phase activities will include the following, as required:

- Reviewing the minutes of the preparatory phase meeting.
- Establishing the level of workmanship required for the DFOW and verifying that it meets minimum acceptable workmanship standards.
- Checking work performed to ensure that it is in full compliance with RAWP requirements.
- Verifying the adequacy of QC procedures to ensure full RAWP compliance.
- Verifying that required control inspections and testing procedures are in place.
- Resolving all differences between specifications and performance.
- Checking work safety procedures and reviewing the SSHP and appropriate AHA to ensure that applicable safety requirements are met; and upgrading the AHA, if required.
- Reviewing the project schedule.

Each initial phase will be recorded on an initial phase inspection checklist form, and these documents will be submitted with the daily QC Report.

9.3 PHASE 3: FOLLOW-UP PHASE

The follow-up phase applies to all DFOWs, and consists of continuing checks to ensure that all requirements of the RAWP applicable to the DFOW are being met. After the initial phase meeting has been conducted and work has started on the DFOW, the PQCM will document in the daily QC Report all control activities that are implemented to ensure compliance with RAWP requirements applicable to that particular feature of work, including each follow-up inspection.

Any deficiencies in quality, workmanship, material, equipment, or supplies, and any unauthorized deviations from engineering requirements or specifications will be recorded on the daily QC Reports. Each deficiency will then be tracked until corrected, as described in Section 6.0. The PQCM has the full authority to act directly with both Gilbane and subcontractor personnel to correct deficiencies.

Follow-up phase activities include, but are not limited to, confirming that:

- Workmanship continues to meet RAWP requirements.

- Deficiencies have been corrected prior to the initiation of subsequent features of work that may be affected by the deficient work.
- All deficiencies have been corrected before a final inspection is requested.

Additional preparatory and initial phases will be conducted for a deficiency if the quality of ongoing work remains or becomes unacceptable.

10.0 PROCEDURES FOR FINAL INSPECTIONS

10.1 FINAL INSPECTION

A final inspection of each DFOW or survey area will be conducted by the Navy ROICC and CSO, Gilbane PQCM, PM and Site Superintendent when all survey activities in an area have been completed. The inspection will include a review of all survey data for the radiation survey area to ensure that all requirements of the RAWP have been met. Any anomalies–i.e., areas not meeting release criteria–will be reviewed and documented.

11.0 REFERENCES

Navy, 2006. *Basewide Radiological Removal Action, Action Memorandum (Revision 2006), Hunters Point Naval Shipyard, San Francisco, California.*

TriEco-Tt Joint Venture (TriEco-Tt), 2012. *Draft Historical Radiological Assessment – Supplemental Technical Memorandum, Naval Station Treasure Island, San Francisco, California.* August.

Weston Solutions, Incorporated (Weston), 2006. *Final Treasure Island Naval Station Historical Radiological Assessment, Former Naval Station Treasure Island, California.* February.

Naval Facilities Engineering Command (NAVFAC) Southwest, year. *Environmental Restoration Recording Keeping Program Manual, Appendix G*.

NAVFAC, year. *Environmental Work Instruction 4*.

TABLE

Table 1: Gilbane Quality Control Team Responsibilities

Gilbane Functional Title	Responsibilities and Relationships
Corporate Quality Assurance (QA)/ Quality Control (QC) Director	• Reports directly to the Executive Vice President for Operations, with direct communications with the Gilbane President for resolving QA/QC issues. • Responsible for audits and general oversight of company-wide QC program. • Provides guidance and support to QC Program Managers and Project QC personnel, and assists with resolution of QC issues that cannot be resolved at the project or program level. • Approves Project Quality Control Manager (PQCM) designees in the absence of the QC Program Manager. • Has full authority to require corrective actions and stop work on any portion of a task if it does not conform to the standards or specifications established for the program.
QC Program Manager	• Reports directly to the Gilbane Corporate QA/QC Director. • Works closely with the Program Manager to assure compliance with the contract-wide quality control program, and has direct access to the Gilbane President to resolve issues that require escalation. • Develops, implements, manages, and enforces the Contract-wide QC program. • Implements and documents program-level quality control activities. • Implements or directs QC audits, internal QC system audits, and system checks to ensure that QC controls and documentation are in place; identifies nonconformance and recommends corrective actions. • Directs and approves any changes to the Program Contractor Data Quality Management Plan (CDQMP) or Contractor Quality Management Plan (CQMP). • Reviews the Contractor Quality Control Plan (CQCP) for adherence to the Program CQMP and project-specific requirements prior to submission. • For each Contract Task Order (CTO), appoints a PQCM whose qualifications meet the requirements specified in the Contract, the CTO, and Gilbane guidelines. • Oversees implementation of Program and CTO-specific QC requirements by the designated project-level field QC representatives. • Readily available for consultation with the Client and project QC

Gilbane Functional Title	Responsibilities and Relationships
	personnel during the CTO activities. • Has full authority to stop work on any portion of a task if it does not conform to the standards or specifications established for the program or CTO. • Has completed the Construction Quality Management for Contractors course, and will maintain this certification while serving as QC Program Manager.
Program Manager	• Serves as the primary Point of Contact (POC) for the Client regarding Contract management. • Supports the Project Manager in identifying and assigning required resources. • Assists with resolution of any project-related issues when needed. • Works closely with the QC Program Manager and Project Managers to assure compliance with the contract-wide quality control program.
Project QC Manager	• Appointed by the QC Program Manager. • Reports directly to the QC Program Manager in implementing, managing, and enforcing the approved CQCP, and will not be subordinate to the Project Manager or Site Superintendent. • May prepare or review the project CQCP. • Maintains a copy of the approved CQCP on the project site and available to project and Client personnel during all work hours. Issues copies of the approved CQCP to project QC staff. • Has primary responsibility for project-level quality control: enforces and manages all QC field operations, protocols, and documentation; responsible for implementation of the Three Phases of Control system; reviews and approves submittals; oversees QC field personnel; ensures that testing is performed as specified; and provides QC certifications and documentation as required in the Contract and CTO. • Works closely with the QC Program Manager to: conduct QC audits; ensure that QC controls and documentation are in place; and identify any nonconformances, and recommend/oversee necessary corrective actions. • Works closely with the Radiation Safety Officer and Project Manager to assure the quality of work on the project. • Attends or conducts the initial QC Meeting, the Coordination and Mutual Understanding Meeting, and any partnering meetings;

Gilbane Functional Title	Responsibilities and Relationships
	conducts the project QC meetings. • Completes and/or approves daily QC reports, weekly QC meeting minutes, project submittals, rework items list, and as-built records, as required. • Has full authority to stop work on any portion of the task that does not conform to the standards or specifications established for the CTO. • Responsible for managing and coordinating all QC documentation submitted by the project QC Specialists, testing laboratory personnel, and any other inspection and testing personnel. • Must have a minimum of five years of combined experience as a superintendent, Project Manager, and/or PQCM on projects similar in type and scope to the designated CTO, with at least two years' experience as a PQCM. [Unified Facilities Guide Specifications (UFGS) 01-45-02] • Must be familiar with the requirements of Engineering Manual (EM) 385-1-1, and have experience in the areas of hazard identification, safety compliance, and sustainability. • Will have completed the Construction Quality Management for Contractors course, and will maintain this certification while serving as PQCM.
	• Direct all testing, and prepare and submit all required reports and QC documentation. • Chair the weekly contractor QC meetings and provide minutes of these meetings. • Compile and review QC reports. • Check incoming material items to ensure their condition and conformance to the contract documents, including approved submittals. • Direct and implement the three-phase QC system of control/ documentation for inspection (Preparatory, Initial, and Follow-Up). • Review and ensure that pertinent portions of the safety plan and appropriate activity hazard analysis (AHA) are covered in the preliminary inspection meetings and are implemented throughout the work. • Maintain a record of field activities. • Review the QC results. • Prepare and submit required project submittals.

Gilbane Functional Title	Responsibilities and Relationships
	• Perform field performance and system audits. • Determine that incidents of noncompliance are reported to the Project Manager and Site Superintendent. • Provide reports or memoranda or both regarding completion of corrective actions. • Prepare and compile the data needed to complete inspection test reports and test forms. • Prepare and submit daily inspection reports for each field activity day to the Navy Resident Officer in Charge of Construction (ROICC) and Remedial Project Manager (RPM). • Update the As-built drawings. • Ensure Photographic Record is maintained. • Document rework and punch list items on daily reports. • Conduct pre-final and final inspections.
Alternate PQCM	• Appointed by the QC Program Manager to serve in the designated PQCM's absence. • The responsibilities of, and qualification requirements for, the Alternate PQCM are the same as for the PQCM, as outlined above.
Project Manager	• Develops task requirements with technical representatives; implements project-specific plans within the project schedule; and maintains and manages the budget. • Responsible for providing a quality product and meeting all contract requirements for quality; oversees compliance with normal safety procedures and regulatory requirements. • Submits a copy of the general description of the work with the names and qualifications of the QC personnel proposed for the project to the QC Program Manager. • Reviews draft QC Plans for adherence to the program CQMP and project-specific requirements prior to submission. • Works closely with the Radiation Safety Officer and PQCM on QC-related matters.
Radiation Safety Officer	• May be designated by the PQCM for areas of work that are of sufficient complexity or size to justify specific technical expertise. • Assist and report to the PQCM to insure that QC requirements are

Gilbane Functional Title	Responsibilities and Relationships
	maintained. • Provide appropriate documentation, testing, and verifications, including Three Phases of Control, for each Definable Feature of Work (DFOW) in their area(s) of responsibility, as assigned. • Attend the applicable QC meetings. • Meet qualifications specified in the Contract, the CTO, and/or the CQCP, based on the tasks and responsibilities assigned. May perform other tasks, as assigned.
Site Supervisor	• Designated by and reports to the Project Manager. • Works closely with the Project QC Manager, Project Manager, and client representatives to assure that the work is performed in compliance with the CQCP, Execution Plan, and drawings and specifications, as applicable. • Has the authority to stop work if contract or CTO requirements are not being met. • All training and experience requirements specified in the contract and CTO.

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FIGURES

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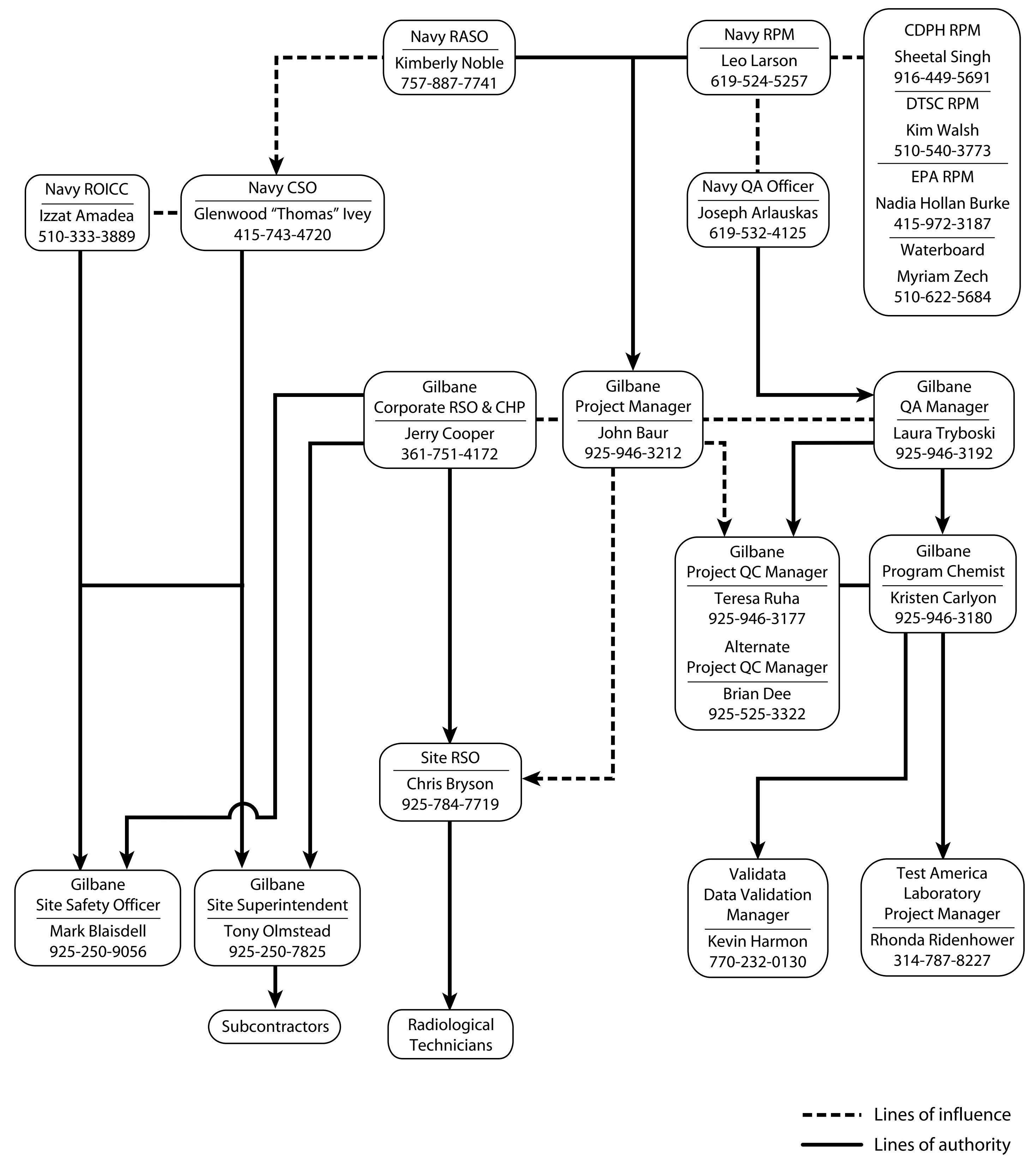

Gilbane	**IR Site 12 Non-SWDA RD/RA** Treasure Island San Francisco, CA	**Figure 1** Project Organizational Chart

NAVFAC Naval Facilities Engineering Command

IR Site 12 Non-SWDA Remedial Action/
SWDA Removal Action
Former Naval Station Treasure Island
San Francisco, CA

Figure 2
Treasure Island Location Map

ATTACHMENT 1

QC APPOINTMENT LETTERS AND RESUMES

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January 12, 2018

Teresa Ruha
Gilbane
1655 Grant Street, Suite 1200
Concord, CA 94520

via email: truha@gilbaneco.com

Subject: Appointment of Project Quality Control Manager
Naval Facilities Engineering Command Southwest RAD MAC II
Contract Number N62473-17-D-0005, CTO F4239
Installation Restoration Site 12, Former Naval Station Treasure Island
San Francisco, CA
Gilbane Project #: J310000300

Dear Ms. Ruha:

You are appointed Project Quality Control (QC) Manager for the above-referenced project. In the QC Manager position, you are required to be on site at all times during field work. You will have the responsibility and complete authority to act for Gilbane Federal (Gilbane) and to take any action necessary to ensure conformance with the contract requirements. Also, your duties are described in the QC Plan approved for this project, and include the following:

- Implement the QC Plan.
- Maintain a copy of the approved QC Plan on file at the job site complete with up-to-date approved revisions.
- Certify and/or approve submittals in accordance with the plans in this Contract.
- Assure that QC staffing is adequate to meet its responsibilities including being staffed with qualified personnel to perform all detailed inspections and testing specified in the plans.
- Conduct daily inspection of work performed each day for compliance with plans.
- Certify daily that all materials and equipment delivered/installed in the work comply with Contract plans. Certify daily that all work performed on site conforms to plans. Report any deficiencies and remedial action planned and performed.
- Coordinate and supervise quality inspections and tests conducted by the members of the QC organization, including subcontractors, to ensure work is performed in accordance with the plan.
- Ensure that all tests required are performed and the results are reported. Indicate whether test results show the item tested or task performed conforms to Contract requirements or not. Ensure that corrective work achieves acceptable test results.

- Authority to remove any individual from the site who fails to perform work in a skillful and safe manner in compliance with EM 385-1-1, or whose work does not comply with the Contract plans.
- Authority to immediately stop any segment of work which does not comply with the Contract plans, and direct the removal and replacement of any defective work.
- Have no authority to deviate from plans without prior approval, in writing, from the Contracting Officer or designated representative.
- Maintain at the job site an up-to-date Deficiencies List on all nonconforming work.

You are to report directly to me on quality matters. If you require any other information, please do not hesitate to call me. You can reach me at 303-749-3944 or 303-513-0849 (mobile).

Sincerely,

Nathan G. Adams, CPE
Gilbane Acting QA/QC Director
Gilbane Federal Support Operations Manager

NGA: cmn

cc: Arvind Acharya, Gilbane Federal Program Manager
John Baur, Gilbane Federal Project Manager

U.S. ARMY CORPS OF ENGINEERS

USACE LEARNING CENTER
HUNTSVILLE, ALABAMA

NAVFAC

CERTIFICATE

TERESA RUHA

SPK511400831

has completed the Corps of Engineers and Naval Facility Engineering Command Training Course

CONSTRUCTION QUALITY MANAGEMENT FOR CONTRACTORS - #784

SACRAMENTO, CA	4/3-4/4/14	SPK-SACRAMENTO	DREW A. PERRY
Location	Training Date(s)	Instructional District/ NAVFAC	CQM-C Manager
DREW A. PERRY	DREW.A.PERRY@USACE.ARMY.MIL	(916) 557-7779	Drew A. Perry
Facilitator/Instructor	Email	Telephone	Facilitator/Instructor Signature

THIS CERTIFICATE EXPIRES FIVE YEARS FROM DATE OF ISSUE
CQM-C Recertification online course: https://www.myuln.net

Gary L. Anderson

Director, USACE Learning Center

Gilbane

Teresa Ruha – Project Geologist

Highlights:

- Thorough knowledge of regulatory agencies including: California EPA Region 9, California Department of Toxic Substances Control (DTSC) Region 1, and the Regional Water Quality Control Board (RWQCB)
- Experienced with CERCLA and RCRA approaches to site characterization and remedial activities
- Coordinated activities to avoid impacting the endangered California Least Tern living on the Alameda Naval Base
- Extensive field experience in the execution of remedial investigations and feasibility studies focused on determining the nature and extent of subsurface contaminants (i.e., volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polynuclear aromatic hydrocarbons (PAHs), pesticides, polychlorinated biphenyls (PCBs), dissolved metals, hexavalent chromium, alkalinity, total dissolved solids (TDS) and radionuclides

Education:	Years of Experience:	Languages:
BS, Geology, California State University Hayward, [redacted]	Total – 17 With Gilbane – 10	

Active Registrations/Certifications/Clearances:	Affiliations:
Lead Sampling Technician, OSHA 30 HR Construction, CQMC, Supervision of Hazardous Waste Sites, Health and Safety for Hazardous Waste Site, First Aid and Blood borne Pathogens, Safety Trained Supervisor in Construction (STS-Construction)	

Training:	Employment History:
40 Hour OSHA 29 CFR 1910.120 HAZWOPER training, through December 2018 Phase I Environmental Site Assessment Training, 2004 Federal Aviation Administration (FAA), Airfield Safety & Security Training, 2001, Innov-X System Trained	2007 – Present: Gilbane 2005 – 2006: Weiss Associate 2000 – 2004: LFR Levine-Fricke

Awards/Commendations:

Project Experience:

Ms. Ruha is a project geologist with 17 years of experience performing environmental remedial actions following CERCLA and RCRA guidelines. Her expertise includes subsurface contamination investigations focused on the design and implementation of environmental sampling programs, soil drilling projects, and the design and installation of monitoring and extraction wells. She is also highly skilled in the development of project plans/reports including Health and Safety Plans, Sampling and Analysis Plans (SAPs), and Remedial Investigation Reports.

Project Field Geologist, Site Health and Safety Officer and Public Relations coordinator – Former Naval Station Treasure Island, San Francisco, CA, 10/12 to 06/14. Coordinated radiological clearance of buildings, structures and land areas. Served as field geologist onsite, and was responsible for preparing procurement requisitions, field documents, scope of work, and health and safety plans.

Project Field Geologist and Task Manager – AMCO EPA Site Groundwater and Vapor Monitoring, Oakland, CA, 06/09 to 02/14. Coordinated low flow Blatypus pump groundwater sampling and soil gas sampling. Served as field task manager and project geologist onsite, and was responsible for preparing procurement requisitions, field documents, scope of work, and health and safety plans. Coordinated field crews, lab deliveries and correspond with EPA Project Manager.

Project Field Geologist - Parcel F Hunters Point Naval Shipyard, South San Francisco, CA, 12/12 to 03/13. Conduct sampling of radiologically impacted sediment on the San Francisco Bay. Sampling included clam deployment and recovery using coring, and SedFlume, which was all performed from a boat. The sampling methods also had to be modified to comply with radiological regulations to ensure that the water and sediment were controlled and contained. Served as field geologist onsite, and was responsible for preparing procurement requisitions, field documents, scope of work, and health and safety plans.

Project Field Geologist – USACE Environmental Restoration Program Travis Air Force Base, Fairfield, CA, 08/09 to 07/10. Further characterized the nature and extent of soil contamination and debris at Site SD001, SD033 and FT005, by taking soil samples and GPS the locations of where the samples were taken. Served as field task manager and project geologist onsite and responsible for preparing procurement requisitions, field documents, scope of work, and health and safety plans. Coordinated field crews and lab deliveries.

Field Sampler – NAVFAC Southwest Division, Lead-Based Paint Evaluation, Former North Housing, Alameda Point, CA, 06/09 to 07/09. Conduct a lead-based paint (LBP) evaluation of the interiors and exteriors of multi-family housing units at the Former North Housing Development (North Housing) for the presence of LBP and LBP hazards. Performed an LBP Inspection using an x-ray fluorescence (XRF) analyzer to determine whether LBP is present and, if LBP is present, a LBP Hazard Assessment involving collection of dust wipe samples and surface soil sample.

Field Sample Coordinator – NAVFAC Southwest Division Petroleum Hydrocarbon Corrective Action Parcel B, Hunter Point Shipyard, San Francisco, CA, 07/09. Coordinated where and when sample points were taken during the remedial excavation conducted at the Parcel B Cap. Reviewed analytical data to determine if sample points were above or below the screening criteria.

Sampling Coordinator – NAVFAC Southwest IDIQ, Basewide Groundwater and Landfill Gas Monitoring, Alameda Point, CA, 08/07 to 02/09. Coordinated quarterly Basewide peristaltic pump sampling and soil gas sampling events for 320 groundwater elevations and 25 soil gas test sites. Served as the field task manager and project geologist onsite, and was responsible for preparing procurement requisitions, field documents, scope of work, and health and safety plans. Coordinated field crews, lab deliveries, and other contractors on site in order to gain access to sampling sites. Prepared and attended meetings with the Navy to discuss project status.

Project Field Geologist – USACE Vault and UST Removal at Former Redding Army Airfield, Redding, CA, 10/08 to 11/08. Coordinated the removal of concrete vaults, underground storage tanks and pipelines and excavated the soil around the former tanks and pipelines. Took soil samples and GPS the locations of where the samples were taken. Served as project geologist onsite and was responsible for field documents, scope of work, and health and safety plans. Coordinated lab deliveries and correspond with USACE Project Manager.

Project Field Geologist and Coordinator – Bioremediation Investigation Study, San Leandro, CA, 04/05 to 08/06. Worked with the DTSC to conduct field investigations in residential areas. Methods included hydrogen release compound (HRC) drilling and the injection of HRC with direct push technologies. Responsibilities included cost estimates, overseeing budgets, Health and Safety Plans, Remedial Investigation Reports.

Project Field Geologist and Coordinator – Phase I Environmental Site Assessments, Napa County, CA, 04/05 to 08/06. The site was examined for any chemicals possibly residing around or within building structures and a chemical inventory was compiled. Responsibilities included site background information, site walk and preparation of investigative reports.

Project Field Geologist – California Regional Water Quality Control Board, Central Valley Region, Lincoln Center Environmental Remediation Trust, Stockton, CA, 08/2000 to 05/04. Installation and soil sampling of fifteen (15) monitoring wells using mud rotary drilling methods to be incorporated into the existing ground water treatment system. Coordinated quarterly groundwater sampling events using submersible pump sampling for 350 groundwater monitoring wells. Collected groundwater samples, and was responsible for preparing scope of work and health and safety plans.

U.S. ARMY CORPS OF ENGINEERS

USACE LEARNING CENTER
HUNTSVILLE, ALABAMA

NAVFAC

CERTIFICATE

TERESA RUHA

SPK511400831

has completed the Corps of Engineers and Naval Facility Engineering Command Training Course

CONSTRUCTION QUALITY MANAGEMENT FOR CONTRACTORS - #784

SACRAMENTO, CA	4/3-4/4/14	SPK-SACRAMENTO	DREW A. PERRY
Location	Training Date(s)	Instructional District/ NAVFAC	CQM-C Manager
DREW A. PERRY	DREW.A.PERRY@USACE.ARMY.MIL	(916) 557-7779	Drew A. Perry
Facilitator/Instructor	Email	Telephone	Facilitator/Instructor Signature

THIS CERTIFICATE EXPIRES FIVE YEARS FROM DATE OF ISSUE
CQM-C Recertification online course: https://www.myuln.net

Gary F. Anderson

Director, USACE Learning Center

Board of Certified Safety Professionals

Upon the recommendation of the
Board of Certified Safety Professionals,
by virtue of the authority vested in it,
has conferred on

Teresa Gayle Ruha

the credential of

Safety Trained Supervisor Construction

and has granted the title as evidence of meeting the qualifications and passing the required examination so long as this credential is not suspended or revoked and is renewed annually and meets all recertification requirements.

STSC

BOARD OF CERTIFIED SAFETY PROFESSIONALS

July 29, 2015
DATE ISSUED

STSC-18084
CERTIFICATION NUMBER

Cece M. Weldon
BOARD PRESIDENT SIGNATURE

Treasa M. Turnbeaugh
BOARD SECRETARY SIGNATURE

January 12, 2018

Brian Dee
Gilbane
1655 Grant Street, Suite 1200
Concord, CA 94520

via email: bdee@gilbaneco.com

Subject: Appointment of Alternate Project Quality Control Manager
Naval Facilities Engineering Command Southwest RAD MAC II
Contract Number N62473-17-D-0005, CTO F4239
Installation Restoration Site 12, Former Naval Station Treasure Island
San Francisco, CA
Gilbane Project #: J310000300

Dear Mr. Dee:

You are appointed Alternate Project Quality Control (QC) Manager for the above-referenced project. In the QC Manager position, you are required to be on site at all times during field work. You will have the responsibility and complete authority to act for Gilbane Federal (Gilbane) and to take any action necessary to ensure conformance with the contract requirements. Also, your duties are described in the QC Plan approved for this project, and include the following:

- Implement the QC Plan.
- Maintain a copy of the approved QC Plan on file at the job site complete with up-to-date approved revisions.
- Certify and/or approve submittals in accordance with the plans in this Contract.
- Assure that QC staffing is adequate to meet its responsibilities including being staffed with qualified personnel to perform all detailed inspections and testing specified in the plans.
- Conduct daily inspection of work performed each day for compliance with plans.
- Certify daily that all materials and equipment delivered/installed in the work comply with Contract plans. Certify daily that all work performed on site conforms to plans. Report any deficiencies and remedial action planned and performed.
- Coordinate and supervise quality inspections and tests conducted by the members of the QC organization, including subcontractors, to ensure work is performed in accordance with the plan.
- Ensure that all tests required are performed and the results are reported. Indicate whether test results show the item tested or task performed conforms to Contract requirements or not. Ensure that corrective work achieves acceptable test results.

- Authority to remove any individual from the site who fails to perform work in a skillful and safe manner in compliance with EM 385-1-1, or whose work does not comply with the Contract plans.
- Authority to immediately stop any segment of work which does not comply with the Contract plans, and direct the removal and replacement of any defective work.
- Have no authority to deviate from plans without prior approval, in writing, from the Contracting Officer or designated representative.
- Maintain at the job site an up-to-date Deficiencies List on all nonconforming work.

You are to report directly to me on quality matters. If you require any other information, please do not hesitate to call me. You can reach me at 303-749-3944 or 303-513-0849 (mobile).

Sincerely,

Nathan G. Adams, CPE
Gilbane Acting QA/QC Director
Gilbane Federal Support Operations Manager
NGA: cmn

cc: Arvind Acharya, Gilbane Federal Program Manager
John Bauer, Gilbane Federal Project Manager
Teresa Ruha, Gilbane Project QC Manager

U.S. ARMY CORPS OF ENGINEERS

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HUNTSVILLE, ALABAMA

NAVFAC

CERTIFICATE

Brian P. Dee

SW9-02-17-00335

has completed the Corps of Engineers and Naval Facility Engineering Command Training Course

CONSTRUCTION QUALITY MANAGEMENT FOR CONTRACTORS - #784

Concord, California	10/19/17 - 10/20/17	SW9 - NAVFAC Southwest	Michael Haliburton PMP, PE
Location	Training Date(s)	Instructional District/ NAVFAC	CQM-C Manager
Kugan Panchadsaram PE	kugan@kugan.com	858-212-2941	
Facilitator/Instructor	Email	Telephone	Facilitator/Instructor Signature

Chief, USACE Learning Center
Jeffrey D. Dziedzic

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Brian Dee

ENVIRONMENTAL SUPERINTENDENT II

Education

Diablo Valley College, Pleasant Hill, CA.
Los Medanos College, Pittsburg, CA [redacted]
Coursework in: Geology, Oceanography, Real Estate and Real Estate Law

Years of Experience

Total – 28 years
With Gilbane – 16 years

Active Registrations | Certifications | Clearances

USACE Construction Quality Management, 2012
Adult CPR and First Aid Certification, 2016
Safety Trained Supervisor (STSC-17598), 2015
Qualified SWPPP Practitioner (QSP) 2014 (pending underlying certification verification)
API-650/653 Storage Tank Management, 2009
California Lead Worker Certification (CDPH), 2010
Nuclear Moisture Density Gauge Operator, 1998

Training | Expertise

HAZWOPER 40-hour Initial Training, 1990
HAZWOPER 8-hr Supervisor, 1995
OSHA 30-hour Construction Safety, 2009 & 2016
X-Ray Fluorescence Radiation Safety Training, 2008
CPR and First Aid AED (Automated External Defibrillator)
Blood borne Pathogens
Radiological Worker I & II 2016
Fire Extinguisher Training 2015
Radiation Awareness
14-Hour Electrical Safety, 1995

Employment History

2010 – Present: Gilbane
2000 – 2010: Innovative Technical Solutions, Inc
1998 – 2000: Levine Fricke Recon
1997 – 1998: IT Corporation (contract employee)
1995 – 1997: ERM West
1994 – 1995: Contract Services, Design Services, Inc.
1993 – 1994: Calgon Carbon Corporation
1988 – 1993: EA Engineering Science and Technology

Experience Summary

Mr. Dee has 28 years of hands-on experience in design, construction, and management of the operation and maintenance (O&M) of remediation systems. He is responsible for construction, installation, startup, monitoring, optimization, and repair of soil vapor extraction (SVE) and groundwater treatment systems. Mr. Dee has supervised soil incineration and oil/water separation operations, municipal water treatment plant construction, site excavations, slurry wall installation, and trenching operations. Additionally, Mr. Dee has served as a construction site superintendent, Quality Control Manager and site Health and Safety Officer for

several field projects. Has produced site specific documents including; work plans, site specific health and safety plans and job hazard analyses.

Project Experience

Field Team Lead/Operations and Maintenance – USEPA Region 9 Remedial Action Contract (RAC), Long Term Response Action, Frontier Fertilizer Superfund Site, Davis, CA, 06/2011 to Present. Performed operation and maintenance (O&M) and optimization of an existing SCADA automated groundwater pump and treatment system to control migration of groundwater containing contaminants of concern (COCs) released at the Site. Served as field team lead for groundwater sample collection events to evaluate the effects of P&T and natural attenuation.

Field Investigations/Sample Coordinator – U.S. Army Corps of Engineers (USACE) Environmental Remediation Services (ERS), Remedial Investigation, FUDS, Fort Mason, San Francisco, CA, 2011. Responsible for field investigations at 16 Areas of Concern at the former Fort Mason site. Environment Impacts resulting from DoD past activities at Fort Mason are being addressed through the FUDS program. Activities included site surveys and soil and groundwater investigation to assess the nature and extent of contamination and site restoration.

Quality Control Manager- U.S. Navy, Petroleum Hydrocarbon Project, Parcel C, Hunters Point Naval Shipyard, San Francisco, CA, 2014. Served as the on-site Quality Control Manager for a hydrocarbon investigation project to complete the characterization of petroleum hydrocarbon-impacted soil and groundwater for eighteen locations. Investigation activities included, soil borings, groundwater monitoring well installations, building sub-slab investigations and site restoration. Some investigation work was conducted in radiologically controlled areas and archaeologically sensitive areas. Responsible for preparatory, initial and follow-up phase quality control requirements.

Former Fire Training Area #4, Travis Air Force Base Environmental Restoration Program, Remedial Action Completion for North/East/West Industrial Operable Unit (NEWIOU)/Operable Unit 2 (OU 2), Travis Air Force Base, Fairfield, CA, 2010-2012. Responsible for field investigations and sample collections at several areas of concern at the former Fire Training Area #4 , Travis Air Force Base site. The site received EPA acceptance for the completion of all the NEWIOU ROD remedial actions in September 2012.

Field Investigations/Sample Coordinator – USACE ERS, Military Ocean Terminal, Concord, CA, 2009 to 2012. Performed post-remediation monitoring and investigation at CERCLA remedial action sub-sites located in a wetlands area and seasonal surface water and groundwater monitoring of an extensive shallow and deep well network. This ERS project included investigation and closure activities for five petroleum sites, some of which contain up to 18 underground storage tanks (USTs).

Field Investigations, Quality Control Manager and Health & Safety Supervisor – EPA Region 9 Remedial Action Contract (RAC), AMCO Chemical Superfund Site, Oakland, CA, 12/4/08 to 3/31/13. Performed feasibility study for determining a remedy that eliminates, reduces, and/or controls risks to human health and the environment under a $2.5 million task order. Field team performed groundwater sample collection events, soil vapor probe installation and sample collection, and subcontractor supervision. The project included residential vapor intrusion sample collection and investigation of owner occupied site homes and surrounding areas.

Sample Coordinator– U.S. Navy, Investigation of Site 31, Military Ocean Terminal, Concord Naval Weapons Station, Concord, CA, 2009 to 2010. Field sample collection efforts for installation of groundwater monitoring wells and soil borings. Field investigations were performed to identify metal contaminates in the subsurface and measure the extent of their possible migration off-site.

Field Survey and Sample Technician – NAVFAC Southwest ID/IQ, Asbestos and Lead Re-Evaluations, Treasure Island/Yerba Buena Island, San Francisco, CA, May 2009 to June 2009. Provided support for on-site inspections for asbestos and lead re-evaluations performed in buildings and residential housing located at Treasure Island and Yerba Buena Island. Noted and documented changes in asbestos material as non-damaged, damaged, or significantly damaged, and identified horizontal locations (i.e., windowsills and floors) to be sampled in the buildings designated by the client. Collected lead-based paint samples in occupied residences under the appropriate chain of custody documentation.

Field Team Lead/Sample Coordinator– USEPA Region 9, Klau and Buena Vista Mines Operable Unit No. 1 (OU1) Remedial Investigation (RI), Paso Robles, CA. Conducted Remedial Investigation activities at Klau/Buena Vista Mines OU1, Superfund Site, San Luis Obispo County. Performed groundwater investigation of a former mercury mine. Field team lead for sample collection activities of quarterly sample collection events.

Remediation System Technical Review– USEPA RAC II, OMEGA NTCRA Groundwater Treatment System Oversight, 2009. Task orders included field inspection and technical review of the extraction and treatment system design, startup, and operation. Responsible for inspection and technical review of system construction, design, Standard Operating Procedures (SOPs), Operations Maintenance and Monitoring Manual, and associated Sampling and Analysis Plan (SAP). Assisted with the preparation of Remedial Action Performance Evaluation Report.

Field Technical Lead/Sample Coordinator – USACE ERS, Vapor Intrusion Analysis Modesto Groundwater Superfund Site, Modesto, CA, 2008 to Present. Performed field investigation activities for the Vapor Intrusion Analysis for the Modesto Groundwater Superfund site. This project was conducted for USEPA Region 9 through USACE ERS as a contract vehicle. A total of four vapor intrusion sampling rounds were at an active cleaners and adjacent business. The initial round included four other business locations. Sub-slab ports were installed at six business locations. Sub-slab grab VOC samples were collected at the ports and multiple 24-hour indoor air ambient samples were collected during the first round. Given that the release area was an active operating dry cleaner, radon measurements were also collected from sub-slab and indoor air locations to provide comparative analysis information. Investigation results were presented in a Vapor Intrusion Report, as well as in a Preliminary Human Health Risk Evaluation.

Field Team Lead – NAVFAC Southwest IDIQ, Basewide Groundwater and Landfill Gas Monitoring, Alameda Point, CA, August 2004 to August 2007. Field team lead on quarterly basewide groundwater and soil gas sampling events. Was responsible for preparing procurement requisitions, field documents, scope of work, health and safety plans, and database entry.

Site Superintendent – USACE, UST Removal, Fuel Farm and Former Airfield, Holtville, CA, 2006. Supervised subcontractors during the excavation and removal several large steel USTs from the former airfield fuel farm. Coordinated confirmation sample collections, tank excavations, and site restoration activities.

O&M Supervisor – Naval Facilities Engineering Command (NAVFAC) Southwest Division, 8(a) RAC, O&M for In-Situ Biosparging System, Marine Corps Base Camp Pendleton, CA, 2003 to 2006. Responsible for the installation, start-up, and O&M of an in-situ biosparging system for this $252,000 task order. Responsibilities included assistance in the preparation of design and plans for system construction. The system construction included the installation of 22 additional air sparge wells and the construction of two additional soil gas/groundwater monitoring points, in-situ biosparging system construction, and electrical power supply connection. O&M activities included monitoring, optimization, sample collection, and equipment repair.

O&M Field Support – U.S. Navy, Southwest Division, Hunters Point Naval Shipyard IDIQ, Parcel C Zero-Valent Iron (ZVI) Injection Treatability Study, 2005. This fixed-priced project implemented a large-scale Treatability Study (72,000 lbs ZVI) to treat chlorinated solvents in groundwater within a 6,500-square-foot area. Responsibilities included subcontractor oversight during field activities, field documentation, and site health and safety.

O&M Supervisor – NAVFAC Southwest Division, Environmental Multiple Award Contract (EMAC), Phase III SVE Treatability Study, Hunters Point Shipyard, San Francisco, CA, 2003 to 2006. Responsible for operations and maintenance of a soil vapor extraction treatment system, including preparation of design and plans for installation of an SVE unit with additional extraction/monitoring wells to plum into existing well field, operation, maintenance, construction, start-up, monitoring, optimization, and equipment repair. Collected samples and monitored system parameters including flow rates and pressures. Monitored and coordinated permit compliance with the Bay Area Air Quality Management District (BAAQMD) for vapor discharge.

Construction Supervisor – Premier Environmental Services, Borel Dry Cleaner Facility SVE, San Mateo, CA, 2003. Responsible for the construction and installation of an SVE treatment system. Responsibilities included the preparation of the design and plans for system construction. The system construction included installation of four vapor extraction wells, associated conveyance plumbing, electrical power supply connection, and system operation building. O&M activities, including start-up, optimization, and repairs.

O&M Supervisor – NAVFAC Southwest Division, O&M Site Soil and Groundwater Treatment Systems, Former Naval Station Treasure Island, San Francisco, CA, 2000 to 2003. Responsible for operations and maintenance of three separate site soil and groundwater treatment systems, including pilot study, design and plans, construction/installation, start-up, monitoring, optimization, and equipment repair. Systems have included thermally-enhanced dual-phase extraction, free product recovery, and soil vapor extraction technologies. Collected samples and monitored system parameters including flow rates and pressures. Monitored and coordinated permit compliance with BAAQMD and the San Francisco Bureau of Environmental Regulation for water discharge.

Remediation Systems Operations – Jones Chemical, Groundwater Treatment System, Milpitas, CA, 1999 to 2000. Responsible for the O&M of a groundwater treatment system, which consisted of 25 groundwater extraction wells to treat trichloroethylene (TCE) contaminants. The process water was treated with packed dual tower air strippers**.**

O&M Supervisor –Environmental Remediation Trust, Accelerated Site Investigation and Remediation, Lincoln Center, Stockton, CA, 1998 to 2000. Responsible for O&M of automated soil-vapor and groundwater remediation system. Systems construction included a 17-well variable frequency drive groundwater extraction system, 500-gallons per minute (gpm) treatment plant and over 5,000-feet of double contained piping, 35-well, 5-acre soil-vapor extraction system, and over 6,000-feet of conveyance piping. Operations and maintenance (O&M) activities included start-up, monitoring, optimization, sample collection and equipment repair. The treatment system incorporated a process supervisory computer system with data acquisition, and remote communication infrastructure. Worked closely with project managers and vendors to resolve calcium fouling in treatment system equipment.

Remediation Systems Operations –Sherwin Williams, Groundwater Treatment System, Emeryville, CA, 1998 to 2000. Responsible for the O&M of a groundwater treatment system to remove arsenic contaminants in the shallow site aquifer. The system consisted of 13 pneumatically operated extraction pumps. System optimization proved difficult due to low yielding extraction wells. The system incorporated an ion-exchange process to remove arsenic from extracted groundwater.

Remediation Systems Operations – Lynch Circuits, Groundwater Treatment System, Sunnyvale, CA, 1998 to 2000. Responsible for the O&M of a programmable logic controller (PLC)-operated dual phase groundwater and vapor extraction treatment system consisting of four groundwater extraction wells and five vapor extraction wells. The process water was treated with a shallow tray air stripper.

Remediation Systems Operations – ACI Glass, Extraction Wells Groundwater Treatment Systems, Santa Clara, CA, 1998 to 2000. Responsible for the O&M of a groundwater treatment system consisting of two extraction wells. The process water was treated with six #300 activated carbon units. Treated water was discharged into a local storm drain.

Remediation Systems Operations – Kinder Morgan Energy Partners, SVE System O&M, Holt, CA, 1998 to 2000. Responsible for the O&M of an SVE system consisting of ten SVE wells treated with three propane-powered internal combustion engines.

Engineering Technician – IT Corporation, Vine Hill Waste Landfill Closure, Martinez, CA, and Panoche Landfill, Benicia, CA, 1996 to 1998. Served as the Engineering Technician and Health & Safety Officer for a hazardous waste landfill closure project. Responsible for monitoring waste excavation and transportation, kept daily logs of all site activities, surveyed all filled and excavated areas, collected compaction samples of filled and compacted lifts, and conducted nuclear density gauge tests of compacted cap material. Also surveyed and assisted in the construction of runoff collection basins for erosion control of excavated areas.

Site Health & Safety Coordinator – IT Corporation, Hazardous Waste Landfill Closure Project, Vinehill Complex, Martinez, CA, 1997 to 1998. Provided Site Health & Safety support for a hazardous waste landfill closure project. Responsible for the health and safety supervision of approximately 40 site workers. Kept daily logs of all site activities, monitored work zones and site perimeters for air quality, provided technical support to construction operations, dust control and monitored slurry wall installation excavations.

Environmental Technician and Remediation Specialist – Environmental Resources Management (ERM) West, Remediation Operations, Walnut Creek, CA, 1995 to 1997. Performed remediation systems operations and construction, served as Health and Safety Officer, and performed air emissions monitoring on multiple projects.

Remediation Systems Operations and Maintenance Supervisor – Southern Pacific Railroad, O&M of Groundwater and Treatment Systems, Sacramento, CA, 1995 to 1997. Responsible for the O&M of three onsite groundwater and SVE treatment systems. Two of the systems were dual soil vapor extraction and groundwater extraction and treatment system. Process water was treated with a shallow tray air stripper and air stripper towers and discharged into a local storm drain. The SVE and air stripper discharge was treated with a thermal catalytic oxidizer unit.

Construction Supervisor – Union Pacific Railroad, Groundwater Treatment System Addition, Sacramento, CA, 1996. Constructed an addition to an existing groundwater treatment system, installing plumbing and electrical lines to add seven groundwater extraction wells. Project included over 5,000 feet of trenching and directional drilling, installation of utility boxes, finished concrete, and asphalt work.

Customer Service Support Services-Calgon Carbon Corporation, San Mateo, Ca. 1993-1994. Responsible for western region support services of granular activated carbon (GAC) filtration systems. Responsibilities included the Construction, installation and maintenance of industrial liquid and vapor-phase systems. Serviced and installed systems for oil refineries, chemical plants, municipal water systems, food and beverage processing and environmental remediation.

Awards | Commendations

Commendation for rapid mobilization to complete excavation work prior to the breeding season of the Western Burrowing Owl, Navy-Time Critical Removal Action, Parcel D, Hunters Point Naval Shipyard, 2005

Commendation for removal of over 150 submerged keel blocks, involved crane operation, and underwater work in challenging conditions, U.S. Navy, Dry Dock 4 Keel Block Removal, Hunters Point Naval Shipyard, 2005

Commendations also from: U.S. Navy, Parcel B SVE/Treatability Study, Hunters Point Naval Shipyard, 2008; U.S. Navy, Hunters Point Remediation, Hunters Point Naval Shipyard, 2008; U.S. Marine Corps Remedial Environmental Action, 2009; U.S. Marine Corps, Camp Pendleton SVE Site 4360-2009; U.S. Navy, IR 28 RAWP, Alameda Point, CA, 2010Title of Award, Organization, YYYY – short quote if applicable>>

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ATTACHMENT 2

SUBMITTAL REGISTER

IR Site 12 Non-SWDA Remedial Action / SWDA Removal Action, Former Naval Station Treasure Island, San Francisco, CA
NAVY - Gilbane SUBMITTAL REGISTER
Contract # N62473-17-D-0005 CTO F4239

LINE NUMBER	SUBMITTAL NUMBER	REVISION NO.	SECTION NO.	ITEM OR DESCRIPTION OF ITEM TYPE OF SUBMITTAL	SUBMITTAL CATEGORY	REVIEW TYPE		SUBCONTRACTOR NAME	DUE DATE TO NAVY	DATE SUBMITTED TO NAVY	DATE RETURN TO GILBANE	DATE TO RESUBMIT TO NAVY (If Applicable)	DATE NAVY		RESUBMITTAL NO.	REMARKS
						GILBANE Approval	GILBANE Info						APPROVED	DIS-APPROVED		

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ATTACHMENT 3

QC FORMS

CONTRACTOR PRODUCTION REPORT

(ATTACH CONTINUATION PAGE AS NEEDED)

DATE:	
REPORT NO.:	

CONTRACT/TO NO:	PROJECT TITLE AND LOCATION:
CONTRACTOR:	SUPERINTENDENT:

AM WEATHER	PM WEATHER	MAX TEMP (F)	MIN TEMP (F)

WORK PERFORMED TODAY

SCHEDULE ACTIVITY NO.	WORK LOCATION AND DESCRIPTION	EMPLOYER	NUMBER	TRADE	HRS

JOB SAFETY

WAS A JOB SAFETY MEETING HELD THIS DATE? (If YES, attach copy of the meeting minutes)	☐ YES	☐ NO	TOTAL WORK HOURS ON JOB SITE THIS DATE (INCLUDE CONT SHEETS)
WERE THERE ANY LOST TIME ACCIDENTS THIS DATE? (If yes, attach copy of completed OSHA report)	☐ YES	☐ NO	CUMULATIVE TOTAL OF WORK
WAS CRANE / MANLIFT / TRENCHING / SCAFFOLD/ HV ELEC./ HIGH WORK/ HAZMAT WORK DONE? (If YES, attach statement or checklist showing inspection performed)	☐ YES	☐ NO	HOURS FROM PREVIOUS REPORT
WAS HAZARDOUS MATERIAL/ WASTE RELEASED INTO THE ENVIRONMENT? (If YES, attach description of incident and proposed action)	☐ YES	☐ NO	TOTAL WORK HOURS FROM START OF CONSTRUCTION

SCHEDULE ACTIVITY NO.	LIST SAFETY ACTIONS TAKEN TODAY/SAFETY INSPECTIONS CONDUCTED TODAY	☐ SAFETY REQUIREMENTS HAVE BEEN MET

EQUIPMENT/MATERIAL RECEIVED TODAY TO BE USED ON JOB SITE (Indicate schedule activity number)

SCHEDULE ACTIVITY NO.	SUBMITTAL #	DESCRIPTION OF EQUIPMENT/MATERIAL USED

CONSTRUCTION AND PLANT EQUIPMENT ON JOB SITE TODAY (Indicate hours used and schedule activity number)

SCHEDULE ACTIVITY NO.	OWNER	DESCRIPTION OF CONSTRUCTION EQUIPMENT USED TODAY (INCLUDING MAKE AND MODEL)

SCHEDULE ACTIVITY NO.	REMARKS

GILBANE SUPERINTENDENT NAME AND SIGNATURE: DATE:

Gilbane Federal	**CONTRACTOR PRODUCTION REPORT** CONTINUATION SHEET	DATE: REPORT NO:
CONTRACT/TO NO:	PROJECT TITLE AND LOCATION:	

WORK PERFORMED TODAY

Schedule Activity No.	WORK LOCATION AND DESCRIPTION	EMPLOYER	NUMBER	TRADE	HRS

Schedule Activity No.	LIST SAFETY ACTIONS TAKEN TODAY/SAFETY INSPECTIONS CONDUCTED

EQUIPMENT/MATERIAL RECEIVED TODAY TO BE INCORPORATED ON JOB SITE (INDICATE SCHEDULE ACTIVITY NUMBER)

Schedule Activity No.	Submittal #	Description of Equipment/Material Received

CONSTRUCTION AND PLANT EQUIPMENT ON JOB SITE TODAY (INDICATE HOURS USED AND SCHEDULE ACTIVITY NUMBER)

Schedule Activity No.	Owner	Description of Equipment Used Today (include Make and Model)	Hours Used

Schedule Activity No.	REMARKS

GILBANE FEDERAL SUPERINTENDENT NAME
AND SIGNATURE: DATE:

INCLUDE ALL PERSONNEL WORK HOURS IN THE “WORK PERFORMED” SECTION ON THIS SHEET
ON THE FRONT PAGE OF THE CONTRACTOR PRODUCTION REPORT

Gilbane Federal

DAILY QUALITY CONTROL REPORT

PHASE	CONTRACT NO. / TO NO.:	GILBANE PROJECT NO.:	REPORT NO.:
	PROJECT TITLE / LOCATION:		DATE:

PREPARATORY

PREPARATORY PHASE INSPECTIONS PERFORMED TODAY YES ☐ NO ☐

(Attach 2-page Preparatory Phase Checklist for each DFOW.)

Schedule Activity No.	Definable Feature of Work	Index No.

INITIAL

INITIAL PHASE INSPECTIONS PERFORMED TODAY YES ☐ NO ☐

(Attach Initial Phase Checklist for each DFOW.)

Schedule Activity No.	Definable Feature of Work	Index No.

FOLLOW-UP

FOLLOW-UP INSPECTIONS PERFORMED TODAY

WORK OBSERVED COMPLIES WITH CONTRACT AS APPROVED DURING INITIAL PHASE? YES ☐ NO ☐

WORK OBSERVED COMPLIES WITH SAFETY REQUIREMENTS? YES ☐ NO ☐

Schedule Activity No.	Description of Work, Definable Feature of Work, Specification Section, Location, and List of Personnel Present

TESTS PERFORMED TODAY (List: tests performed, methods used, personnel performing the tests. Note equipment calibration checks, test locations, test results.)

REWORK ITEMS IDENTIFIED TODAY (not corrected by close of business)		**REWORK ITEMS CORRECTED TODAY (from Rework Items List)**	
Schedule Activity No.	DFOW / Description	Schedule Activity No.	DFOW / Description

MATERIAL RECEIPT INSPECTIONS PERFORMED

Supplier	Material Received/Results (Attach completed Material Receipt Inspection Checklists)

INSTRUCTIONS GIVEN TO SUBCONTRACTORS OR RECEIVED FROM CLIENT; DIFFERING SITE CONDITIONS, ERRORS, OR DISCREPANCIES NOTED:

REMARKS (Representatives on site, etc.; also explain any Follow-Up Phase inspection items from above that were answered "NO")

Schedule Activity No.	Description

DAILY QUALITY CONTROL REPORT

Gilbane Federal

PHASE	CONTRACT NO. / TO NO.:	GILBANE PROJECT NO.:	REPORT NO.:
	PROJECT TITLE / LOCATION:		DATE:

On behalf of Gilbane, I certify that this report is complete and correct, and that the equipment and material used and the work performed during this reporting period are in compliance with the contract plans, drawings, and specifications to the best of my knowledge, except as noted in this report.	PROJECT QC MANAGER PRINT NAME AND SIGN	DATE

NOTE: Include, as applicable, the following as attachments to the Daily QC Report: Daily Production Report, Subcontractor daily logs, material receipts and bills of lading, inspection and test results, Nonconformance Reports, Site Safety Sign-in Logs, and other records developed or received on the date of the report.

GOVERNMENT QUALITY ASSURANCE REPORT		DATE
QUALITY ASSURANCE REPRESENTATIVES REMARKS AND/OR EXCEPTIONS TO THE REPORT:		
GOVERNMENT QUALITY ASSURANCE MANAGER SIGNATURE	PRINTED NAME	DATE

Gilbane Federal

DEFICIENCY LIST

CONTRACT NO. / TO NO.:	PROJECT TITLE / LOCATION:	ITSI GILBANE PROJECT NO.:	
DEFINABLE FEATURE OF WORK, PHASE OF WORK, OR WORK AREA:		BEGIN DATE:	THROUGH DATE:

LOG NO.	**DATE IDENTIFIED**	**DESCRIPTION** (Nature of work, location, other items potentially impacted, etc.)	**CONTRACT REQUIREMENT** (Spec. Section and Par. No., Drawing No., Detail No., etc.)	**ACTION TAKEN BY QC MANAGER**	**RESOLUTION** (Indicate NCR No. if applicable)	**DATE COMPL.**	**INITIALS & DATE VERIFIED**

Gilbane Federal

DEFINABLE FEATURES OF WORK TRACKING LOG

CONTRACT / TO NO.:		PROJECT TITLE / LOCATION:	ITSI GILBANE PROJECT NO.:		
ACTIVITY NUMBER	SPECIFICATION SECTION	FEATURE OF WORK	DATE PREPARATORY PHASE COMPLETED	DATE INITIAL PHASE COMPLETED	DATE DFOW COMPLETE

Gilbane Federal

FINAL INSPECTION FORM

CONTRACT NO /TO NO:	ITSI GILBANE PROJECT NO.:
PROJECT TITLE / LOCATION:	FINAL INSPECTION DATE & TIME:

DEFICIENCY	ACCEPTED (Date/Initials))

AUTHORIZED AGENTS ACCEPTANCE:

PROJECT/QC MANAGER SIGNATURE AND PRINTED NAME | DATE

BASE INSPECTOR/PERSONNEL (NAME & UNIT) SIGNATURE AND PRINTED NAME | DATE

CO or REPRESENTATIVE (NAME & UNIT) SIGNATURE AND PRINTED NAME | DATE

Gilbane Federal

INITIAL PHASE CHECKLIST

CONTRACT NO. / TO NO.:		GILBANE PROJECT NO.:	
PROJECT TITLE / LOCATION:		DATE:	INDEX NO:
DEFINABLE FEATURE OF WORK:	SCHEDULE ACTIVITY NO.:	SPECIFICATION SECTION:	

PERSONNEL PRESENT

CLIENT REP NOTIFIED ☐ HOURS IN ADVANCE: YES ☐ NO ☐

NAME	TRADE/DUTY/POSITION	COMPANY/AGENCY

PROCEDURE COMPLIANCE

CONFIRM FULL COMPLIANCE WITH PROCEDURES IDENTIFIED AT PREPARATORY PHASE. CONFIRM COORDINATION BETWEEN PLANS, SPECIFICATIONS, AND SUBMITTALS.	YES ☐ NO ☐
COMMENTS:	

PRELIMINARY WORK

IS PRELIMINARY WORK COMPLETE AND CORRECT?	YES ☐ NO ☐
IF NOT, WHAT ACTIONS TAKEN?	

WORKMANSHIP

IS REQUIRED LEVEL OF WORKMANSHIP ESTABLISHED?			YES ☐ NO ☐ (IF “NO,” EXPLAIN IN “COMMENTS.”)
WHERE IS WORK LOCATED?			
IS SAMPLE PANEL REQUIRED?	YES ☐	NO ☐	(IF “YES,” MAINTAIN IN PRESENT CONDITION AS LONG AS POSSIBLE. AND DESCRIBE LOCATION OF SAMPLE.)
WILL THE INIITAL WORK BE CONSIDERED AS A SAMPLE?	YES ☐	NO ☐	
COMMENTS:			

RESOLUTION

RESOLVE ANY DIFFERENCES:

COMMENTS:

CHECK SAFETY

WERE JOB CONDITIONS REVIEWED USING EM 385-1-1 AND ACTIVITY HAZARD ANALYSIS?	YES ☐ NO ☐ (IF “NO,” EXPLAIN IN “COMMENTS.”)
COMMENTS:	

OTHER

OTHER ITEMS OR REMARKS:

GILBANE QC MANAGER SIGNATURE AND PRINTED NAME	DATE

Gilbane Federal

INTERNAL COMPLETION PUNCHLIST

CONTRACT NO / TO NO:	ITSI GILBANE PROJECT NO.:
PROJECT TITLE/LOCATION:	DATE:

LOCATION	DEFICIENCY	RESPONSIBLE PARTY	DATE CORRECTION TO BE COMPLETED	DATE CORRECTION COMPLETED	ACCEPTED CORRECTIONS (QCM Initials/Date)	REMARKS

AUTHORIZED AGENT'S ACCEPTANCE:

QC MANAGER SIGNATURE AND PRINTED NAME

DATE

Gilbane Federal

MASTER DOCUMENT LIST

CONTRACT NO / TO NO:	ITSI GILBANE PROJECT NO.:
PROJECT TITLE / LOCATION:	DATE:

		Client		ITSI Gilbane		Document Type			
Document number	Date sent	Addressee	Agency	Author	Staff Responsible	Letter	Report	Plan	Document Title/Description

Gilbane Federal

MATERIAL RECEIPT INSPECTION CHECKLIST

CONTRACT NO. / TO NO.:	ITSI GILBANE PROJECT NO.:	
PROJECT TITLE / LOCATION:	DEFINABLE FEATURE OF WORK:	DATE:
DESCRIPTION OF MATERIALS INSPECTED:		
SUPPLIER NAME:		
NAME OF SUBCONTRACTOR TAKING DELIVERY:		
PLANNED USE OF MATERIAL:		
DOCUMENTS USED DURING THE INSPECTION:		
SPECIFICATION SECTION:		
ARE ALL MATERIALS IN COMPLIANCE WITH THE PROCUREMENT DOCUMENTS AND APPROVED SUBMITTAL?		YES ☐ NO ☐
IF NOT, EXPLAIN:		
ARE THE MATERIALS IN COMPLIANCE WITH THE BUY AMERICAN ACT?		YES ☐ NO ☐
IF NOT, EXPLAIN AND INDICATE IF WAIVER RECEIVED:		
OTHER COMMENTS? NOTE NCR NUMBER, IF APPLICABLE.		
ITSI GILBANE QC REPRESENTATIVE NAME AND SIGNATURE		DATE

NOTE: ATTACH COPY OF DELIVERY RECEIPTS/PACKING LISTS, TEST RESULTS AND PHOTOGRAPHS.

Gilbane Federal

NONCONFORMANCE/CORRECTIVE ACTION REPORT

CONTRACT NO. / TO NO.:	ITSI GILBANE PROJECT NO.:
PROJECT TITLE / LOCATION:	DATE:
	NCR LOG NO.:

PART A: DESCRIPTION OF NONCONFORMANCE/DEFICIENCY (INCLUDE SPECIFIC REQUIREMENT REFERENCES):

IDENTIFIED BY:	DATE:

PART B: ROOT CAUSE:

PART C: CORRECTIVE AND PREVENTIVE ACTIONS

CORRECTIVE ACTIONS TO BE TAKEN (LIST AS CA 1, CA 2, ETC. FOR REFERENCE):

	PROPOSED COMPLETION DATES:

PREVENTIVE ACTIONS TO BE TAKEN (LIST AS PA 1, PA.2, ETC. FOR REFERENCE):

	PROPOSED COMPLETION DATES:
RESPONSIBLE MANAGER PRINTED NAME AND SIGNATURE	DATE

PART D: ACCEPTANCE:

QC MANAGER SIGNATURE AND PRINTED NAME	DATE:
CORRECTIVE ACTION(S) VERIFIED BY (ATTACHED LIST WITH REFERENCE NUMBERS IF NOT VERIFIED AT SAME TIME.)	DATE:

Gilbane Federal

NONCONFORMANCE REPORT/CORRECTIVE ACTION TRACKING LOG

CONTRACT NO./ TO NO.:	ITSI GILBANE PROJECT NO.:
PROJECT TITLE / LOCATION:	

NCR #	ISSUE DATE	PROBLEM DESCRIPTION	CORRECTIVE OR PREVENTIVE ACTIONS	COMPLETION DATE	VERIFICATION/ CLOSURE DATE

Gilbane Federal

OPERATION AND MAINTENANCE INSTRUCTION RECORD

CONTRACT NO. / TO NO.:	ITSI GILBANE PROJECT NO.:
PROJECT TITLE / LOCATION:	
REFERENCE SPECIFICATION (SECTION / PARAGRAPH):	DATE INSTRUCTION PROVIDED:
OPERATION AND MAINTENANCE INSTRUCTIONS WERE CONDUCTED FOR (TYPE OF EQUIPMENT):	
DOCUMENTS / MANUALS PROVIDED / REVIEWED:	

The following personnel were present:

Printed Name	Signature

The personnel identified herein by their signatures certify that they have been instructed in the operation and maintenance of the above-mentioned equipment.

Instructions Were Given By:

Instructor Signature and Printed Name

ITSI Gilbane Representative Signature and Printed Name

Gilbane Federal

PRE-FINAL INSPECTION FORM

CONTRACT NO. / TO NO.:	ITSI GILBANE PROJECT NO:
PROJECT TITLE / LOCATION:	PRE-FINAL INSP DATE:

DEFICIENCY	ACCEPTED (Date/Initials)

AUTHORIZED AGENTS' ACCEPTANCE:

PROJECT/QC MANAGER SIGNATURE AND PRINTED NAME — DATE

BASE INSPECTOR/PERSONNEL (NAME & UNIT) SIGNATURE AND PRINTED NAME — DATE

COR SIGNATURE AND PRINTED NAME — DATE

Gilbane Federal

PREPARATORY PHASE CHECKLIST

CONTRACT NO. / TO NO.:		GILBANE PROJECT NO.:	
PROJECT TITLE / LOCATION:		DATE:	INDEX NO.:
DEFINABLE FEATURE OF WORK:	SCHEDULE ACTIVITY NO.:	SPECIFICATION SECTION:	

PERSONNEL PRESENT

CLIENT REP. NOTIFIED __ HOURS IN ADVANCE? YES ☐ NO ☐

NAME	TRADE/DUTY/POSITION	COMPANY/AGENCY

SUBMITTALS

REVIEW SUBMITTALS AND/OR SUBMITTAL REGISTER. HAVE ALL SUBMITTALS BEEN APPROVED? YES ☐ NO ☐

IF "NO," WHAT ITEMS HAVE NOT BEEN SUBMITTED?

ARE ALL MATERIALS ON SITE? YES ☐ NO ☐

IF "NO," WHAT ITEMS ARE MISSING?

CHECK APPROVED SUBMITTALS AGAINST DELIVERED MATERIAL (THIS SHOULD BE DONE AS MATERIAL ARRIVES).

COMMENTS:

MATERIAL STORAGE

ARE MATERIALS STORED PROPERLY? YES ☐ NO ☐

IF "NO," WHAT ACTIONS TAKEN?

SPECIFICATIONS

REVIEW EACH APPLICABLE SPECIFICATION PARAGRAPH

LIST SPECIFICATIONS COVERED:

DISCUSS PROCEDURES FOR ACCOMPLISHING THE WORK:

CLARIFY ANY DIFFERENCES:

PRELIMINARY WORK & PERMITS

IS PRELIMINARY WORK CORRECT? YES ☐ NO ☐ ARE PERMITS ON FILE? YES ☐ NO ☐

IF "NO," WHAT ACTIONS TAKEN?

Gilbane Federal

PREPARATORY PHASE CHECKLIST

CONTRACT NO. / TO NO.:		GILBANE PROJECT NO.:	
PROJECT TITLE / LOCATION:		DATE:	INDEX NO.:
DEFINABLE FEATURE OF WORK:	SCHEDULE ACTIVITY NO.:	SPECIFICATION SECTION:	

TESTING	IDENTIFY TESTS TO BE PERFORMED, FREQUENCY, AND BY WHOM. (Reference Item of Work as identified on Testing Plan and Log)
	WHEN REQUIRED?
	WHERE REQUIRED?
	REVIEW TESTING PLAN.
	ARE TESTING FACILITIES APPROVED? YES ☐ NO ☐
	IF "NO," WHAT ACTIONS TAKEN?
SAFETY	IS ACTIVITY HAZARD ANALYSIS APPROVED? YES ☐ NO ☐
	REVIEW APPLICABLE PORTIONS OF EM 385-1-1.
	COMMENTS:
MEETING COMMENTS	CLIENT AND AGENCY REPRESENTATIVES' COMMENTS DURING MEETING:
OTHER ITEMS OR REMARKS	

GILBANE QC MANAGER:SIGNATURE AND PRINTED NAME	DATE

Gilbane Federal

REQUEST FOR INFORMATION

CONTRACT NO. / TO NO.:	DATE ISSUED:	RFI NO.:

PROJECT TITLE / LOCATION:	DATE REQUIRED:
ITSI GILBANE PROJECT NO.:	PRIORITY: ☐ Critical ☐ Routine

SUBMITTED TO: Address: Phone:	**SUBMITTED BY:** Address: Phone / E-mail:

SUMMARY DESCRIPTION:

DRAWING REFERENCE:	**SPECIFICATION SECTION:**

INFORMATION REQUIRED:

PROPOSED SOLUTION/SUGGESTED ALTERNATIVES/RECOMMENDED ACTION (IF APPLICABLE):

ATTACHMENTS / NUMBER OF PAGES:

COST IMPACT: ☐ ADDITIONAL COST: ☐ NO CHANGE: ☐ CREDIT: ☐ TBD: [$ ___] ROM

SCHEDULE IMPACT: ☐ YES: ☐ NO: ☐ TBD: [__] ESTIMATED DAYS:

Note: The Government response is not authorization to proceed with work involving a change in contract cost, time, or both. If the response requires such, a formal contractual modification in accordance with the applicable contract documents is required from the client.

Gilbane Federal

REQUEST FOR INFORMATION

CONTRACT NO. / TO NO.:	DATE ISSUED:	RFI NO.:

RFI Transmittal – ITSI Gilbane Approval

ITSI GILBANE PROJECT MANAGER:	PROJECT QUALITY CONTROL MANAGER:
SIGNATURE / DATE:	SIGNATURE / DATE:

TO BE COMPLETED BY GOVERNMENT

Contracting Officer Response / Disposition / Concurrence

RESPONSE:

RESPONSE FROM:	**DATE ANSWERED:** **DATE FORWARDED:**
ATTACHMENTS FROM RESPONDER:	**COPY TO:**

Government Approval – RFI Response

CONTRACTING OFFICER:	**CONSTRUCTION MANAGER:**
SIGNATURE / DATE:	**SIGNATURE / DATE:**

Gilbane Federal

REWORK ITEMS LIST

CONTRACT NO. / TO NO.:	PROJECT TITLE / LOCATION:	GILBANE PROJECT NO.:	
DEFINABLE FEATURE OF WORK, PHASE OF WORK, OR WORK AREA:		BEGIN DATE:	THROUGH DATE:

LOG NO.	**DATE IDENTIFIED**	**DESCRIPTION** (Nature of work, location, other items potentially impacted, etc.)	**CONTRACT REQUIREMENT** (Spec. Section and Par. No., Drawing No., Detail No., etc.)	**ACTION TAKEN BY QC MANAGER**	**RESOLUTION** (Indicate NCR No. if applicable)	**DATE COMPL.**	**INITIALS & DATE VERIFIED**

Gilbane Federal

REQUEST FOR INFORMATION LOG

CONTRACT NO / TO NO:		RFI LOG DATE REVISED:	
PROJECT TITLE / LOCATION:			
ITSI GILBANE PROJECT NO:		PREPARED BY:	

REQUESTS FOR INFORMATION				ACTION			RFI STATUS	
RFI NO.	SCHEDULE ACTIVITY NO.	DESCRIPTION	RECIPIENT	DATE ISSUED	DATE REQUIRED	DATE RESPONDED	COMMENTS COST/SCHEDULE IMPACT	CLOSED
001								
002								
003								
004								
005								
006								
007								
008								
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011								
012								
013								
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025								

TESTING PLAN AND LOG

CONTRACT NO. / TO NO.:	PROJECT TITLE / LOCATION:	GILBANE PROJECT NO.:

SPECIFICATION SECTION AND PARAGRAPH NUMBER	ITEM OF WORK	TEST REQUIRED	ACCREDITED/ APPROVED LAB		SAMPLED BY	TESTED BY	LOCATION OF TEST		DATE COMPLETED	DATE FORWARDED TO CONTRACT. OFFICER	REMARKS
			YES	NO			ON SITE	OFF SITE			

Gilbane Federal

TRAINING COURSE ATTENDANCE RECORD

CONTRACT NO. / TO NO.:		ITSI GILBANE PROJECT NO.:
PROJECT TITLE / LOCATION:		DATE:
CLASS DESCRIPTION:		INSTRUCTOR:
START TIME:	FINISH TIME:	TOTAL HOURS:
TOPICS COVERED:		

NO.	PRINT NAME	SIGNATURE	COMPANY / DIVISION
1			
2			
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APPENDIX E

RADIOLOGICAL MANAGEMENT AND DEMOLITION PLAN

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Naval Facilities Engineering Command Southwest
BRAC PMO West
San Diego, CA

FINAL
REMEDIAL ACTION/NON-TIME CRITICAL REMOVAL ACTION RADIOLOGICAL MANAGEMENT AND DEMOLITION PLAN

Installation Restoration Site 12

Report, Exhibits and Attachments 1-4

Former Naval Station Treasure Island, San Francisco, CA

September 2018

Approved for public release; distribution is unlimited

DCN: GLBN-0005-4239-0011

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Former Naval Station Treasure Island, San Francisco, CA

September 2018

Prepared for:

Department of the Navy
Naval Facilities Engineering Command Southwest
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Contract Number: N62473-17-D-0005; Task Order: N6247317F4239

DCN: GLBN-0005-4239-0011

Gilbane Project No. J310000300

TABLE OF CONTENTS

LIST OF EXHIBITS

LIST OF ATTACHMENTS

ABBREVIATIONS AND ACRONYMS

ACM	asbestos-containing material
ANL	Argonne National Laboratory
Bi-214	bismuth-214
BRAC	Base Realignment and Closure
CDPH	California Department of Public Health
cm	centimeter
cm^2	square centimeter
COC	chemical of concern
cpm	counts per minute
CSM	conceptual site model
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DQO	data quality objective
dpm	disintegrations per minute
EPA	U.S. Environmental Protection Agency
Gilbane	Gilbane Federal
IAEA	International Atomic Energy Agency
IR	installation restoration
ISO	International Organization for Standardization
K-40	potassium-40
keV	kilo-electron volts
LBGR	lower bound of gray region
LBP	lead-based paint
LLRW	xlow-level radioactive waste
m	meter(s)
m^2	square meter(s)
M&E	material and equipment
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	minimum detectable concentration
MEV	mega-electron volts
mg/cm^2	milligrams per square centimeter
mrem/yr	millirem per year
N/A	not applicable
NaI	sodium iodide
NAVSTA TI	Former Naval Station Treasure Island
Navy	U.S. Department of the Navy
NRC	U.S. Nuclear Regulatory Commission
Pb-210	lead-210
Pb-214	lead-214
pCi/g	picocuries per gram
Po-210	polonium-210
Po-218	polonium-218
RA	remedial action

Ra-226	radium-226
RASO	Naval Sea Systems Command Detachment, Radiological Affairs Support Office
RCA	radiologically controlled area
RG	remediation goal
RMDP	Radiological Management and Demolition Plan
Rn-222	radon-222
RO	discrete radioactive object
ROI	regions of interest
RSI	Radiation Solutions, Inc.
RSY	radiological screening yard
SAP	Sampling and Analysis Plan
SWDA	solid waste disposal area
UBGR	upper bound of gray region

1.0 INTRODUCTION

This site-wide Radiological Management and Demolition Plan (RMDP) details the radiological survey design and sampling, release criteria, data quality objectives, and other radiological aspects of the remedial action (RA) for soil contamination of the areas outside the solid waste disposal areas (SWDAs) within Installation Restoration (IR) Site 12 and the continuation of the IR Site 12 Non-Time Critical Removal Action at the Northpoint SWDA at the former Naval Station Treasure Island (NAVSTA TI), San Francisco, California.

This RMDP was prepared by Gilbane Federal (Gilbane) for the U.S. Department of the Navy (Navy) Base Realignment and Closure (BRAC) Program Management Office West under Radiological Environmental Multiple Award Contract N62473-17-D-0005, Contract Task Order N62473-17-F-4239, with the Naval Facilities Engineering Command Southwest. The Naval Sea Systems Command Detachment, Radiological Affairs Support Office (RASO) serves as the technical advisor for the radiological management of the RA.

1.1 PROJECT OVERVIEW

The *Remedial Action / Non-Time Critical Removal Action Work Plan, Former Naval Station Treasure Island, San Francisco, California* (Work Plan; Gilbane, 2017), to which this plan is an appendix, describes the RA to be performed – to excavate discrete locations of soil with chemical of concern (COCs) above their remediation goals (RGs) and dispose of the soil offsite. This includes confirming that radium-226 (Ra-226) in soil is below its RG. A secondary objective of this project is to collect radiological data of the post-RA or “as-left” conditions of each excavation to better inform the IR Site 12 conceptual site model (CSM) for areas outside of the SWDAs as to the presence and extent of radioactive contamination due to housing construction grading.

IR Site 12 is radiologically impacted as documented in the *Final Historical Radiological Assessment Supplemental Technical Memorandum, Naval Station Treasure Island, San Francisco, California* (TriEco-Tt, 2014). Potential sources of radioactivity in RA areas are discrete radioactive objects (ROs) containing Ra-226 such as deck markers, foils coated with radium salts, instrument gauges, and soil contamination from degraded objects. Although there is no evidence that any buildings in IR Site 12 are radioactively contaminated, they are located within an area deemed radiologically impacted.

The radiological management and demolition activities described in this RMDP are designed to collect sufficient data to: (1) achieve the radiological release of the material from buildings to be demolished as part of the RA, which will allow the material to be disposed at a Class III landfill as construction debris; and (2) support the overall goal of obtaining additional lines of evidence to support the IR Site 12 radiological CSM.

1.2 REGULATORY FRAMEWORK

Radioactive materials, including radioactive waste, are managed under Navy oversight. While the Navy is recognized as owner of the radioactive materials at NAVSTA TI, the materials are not currently permitted under the Navy's Master Materials License as the materials are considered residual contamination from previous operations which were appropriately decommissioned at the time of termination or were not considered licensed radioactive materials by the U.S. Nuclear Regulatory Commission (NRC) at the time of use.

Navy policy requires the contractor performing the radiological work to maintain independent license authority. Gilbane possesses a current radioactive material license from the State of California (License No. 7948-07). Radioactive material possessed by Gilbane under its radioactive materials license will consist of contaminated material and equipment (M&E), soil, and debris generated by remediation activities. This material will be maintained under Gilbane's radioactive materials license until properly transferred to the Navy's low-level radioactive waste (LLRW) contractor at the completion of the project, or sooner if project logistics support it.

Gilbane will coordinate with the Navy Resident Officer in Charge of Construction, Caretaker Site Office, RASO, and the Navy's LLRW contractor to ensure proper radioactive material management. This includes identifying, establishing, and maintaining temporary facilities for the storage and handling of radioactive material in its possession.

The memorandum of understanding among radioactive material licensees working at NAVSTA TI will be revised to include Gilbane to ensure proper interfacing of radioactive material handling responsibilities, including a clear LLRW disposal path.

1.3 RADIOLOGICAL CONTROLS

Because IR Site12 is a radiologically impacted area, all field activity elements, include building demolition, soil excavation, confirmation sampling, and waste management, will be performed under radiological controls appropriate to the activity. Trucks, machinery, and equipment will be surveyed prior to exit from a radiologically controlled area (RCA) and once released from the project to confirm they are not radioactively contaminated. Excavated soil will be handled as radioactive material until it has been radiologically screened and its release concurred with by the Navy.

Wherever possible, radiation and contamination will be controlled at their source. RCAs will be established where potentially contaminated M&E will be handled, characterized, or stored for disposal. Radiological controls will be instituted to provide positive control of radioactive material, including ROs that may be discovered, prevent the inadvertent release of radioactive material to uncontrolled areas, and minimize the amount of radioactive waste generated during survey and remediation activities. Barriers and signage appropriate to site conditions will be used to demarcate the RCA boundary and clearly communicate the radiological hazard that is present, as well as to control access and egress of personnel, equipment, and material into and out of the area. Work activities within an RCA will be conducted under a radiation work permit that details radiologically based requirements and protective measures commensurate with the hazards associated with the specific activities being conducted. Workers will be radiologically monitored for contamination prior to exiting the RCA. Once established, an RCA will be maintained until survey and/or sampling confirm that radiological controls are no longer necessary. Construction-related controls (e.g., fencing, barrier ribbon, signage, etc.) will remain in place until the excavation is backfilled and the site restored.

Radiological controls will be implemented in accordance with the Radiation Protection Plan, issued as a separate document in support of the Work Plan (Gilbane, 2017). Radiation protection activities will include personnel dosimetry, radiation monitoring, contamination control, and air sampling, as well as measures to maintain exposures to radiation and radioactive material as low as reasonably achievable.

2.0 RELEASE CRITERIA AND SCREENING LEVELS

The release criteria and screening levels are designed to ensure that residual radioactivity will not result in members of the general public being exposed to unacceptable levels of radiation or radioactive materials. This includes achieving: (1) the radiological unrestricted release of building demolition materials so they can be disposed at a Class III landfill, and (2) the RG for Ra-226 in soil within IR Site 12.

2.1 RADIONUCLIDES OF CONCERN

The radionuclide of concern is Ra-226. Ra-226 occurs in nature as a decay product of naturally occurring uranium. Ra-226 has a half-life of 1,600 years. The primary modes of decay, including the particle radiation energy in mega-electron volts (MeV), for Ra-226 and its short half-life progeny are shown in **Exhibit 2-1**. Due to the short half-lives of its progeny radon-222 (Rn-222), polonium-218 (Po-218), lead-214 (Pb-214), bismuth-214 (Bi-214), and polonium-210 (Po-210), there are essentially four alpha particle and two beta particle emissions with every atomic transformation of Ra-226. However, because Rn-222 is a noble gas, progeny contributions to detectable Ra-226 activity are reduced due to radon emanation from the surface being measured.

Exhibit 2-1. Radioactive Properties of Ra-226 and its Short Half-Life Progeny

Radionuclide	Half-Life	Mode of Decay	Radiation Energy (MeV)	
			Alpha	Beta[a]
Ra-226	1,600 years	alpha	4.8	
Rn-222	3.8 days	alpha	5.5	
Po-218	3.1 minutes	alpha	6.0	
Pb-214	27 minutes	beta		0.25
Bi-214	20 minutes	beta		0.66
Po-214	<0.01 seconds	alpha	7.7	
Pb-210	22 years	beta		0.038

Note:
[a] sum of radiation energies per disintegration

The decay chain of Ra-226 extends beyond lead-210 (Pb-210), though secular equilibrium has not yet been achieved due to the longer half-life of Pb-210 (22.3 years) relative to other Ra-226 progeny. The beta particles emitted by Pb-214 and Bi-214 could also be used to detect Ra-226, though no particular advantage is offered with beta particle detection over alpha particle detection.

2.2 MATERIAL RELEASE CRITERIA

The average acceptable surface contamination levels specified in Table 3 of Regulatory Guide 8.23, *Radiation Safety Surveys at Medical Institutions* (NRC, 1981) will be used as the material release criteria. The Regulatory Guide 8.23 values, in units of disintegrations per minute per 100 square centimeters (dpm/100 cm^2), are reproduced in **Exhibit 2-2**. Materials will meet these criteria or will be controlled as radioactively contaminated.

Exhibit 2-2. Acceptable Surface Contamination Limits

Nuclide [a]	Average [b,c]	Maximum [b,d]	Removable [b,e]
U-nat, U-235, U-238, and associated decay products	5,000 dpm α/100 cm^2	15,000 dpm α/100 cm^2	1,000 dpm α/100 cm^2
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm/100 cm^2	300 dpm/100 cm^2	20 dpm/100 cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000 dpm/100 cm^2	3,000 dpm/100 cm^2	200 dpm/100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5,000 dpm β-γ/100 cm^2	15,000 dpm β-γ /100 cm^2	1,000 dpm β-γ/100 cm^2

Notes:

[a] Where surface contamination by both alpha- and beta-gamma emitting nuclides exists, the limits established for alpha and beta-gamma emitting nuclides should be applied independently.

[b] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[c] Measurements of average contamination level should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each object.

[d] The maximum contamination level applies to an area of not more than 100 cm^2.

[e] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

As a general rule to eliminate the need for isotopic identification, alpha-emitting surface radioactivity is assumed to be Ra-226 and is limited the corresponding **Exhibit 2-2** values (i.e., 100 dpm/100 cm^2 average and 20 dpm/100 cm^2 removable). Since there are no beta-emitting radionuclides of concern, the **Exhibit 2-2** values for beta-gamma emitters will be used (i.e., 5,000 dpm/100 cm^2 average and 1,000 dpm/100 cm^2 removable). Otherwise, isotopic identification will be performed and the isotope-appropriate **Exhibit 2-2** values will be used.

2.3 SOIL SCREENING LEVEL

The screening level for Ra-226 in soil is 1.69 picocuries per gram (pCi/g), which includes the soil naturally-occurring Ra-226 background contribution. Soil with Ra-226 concentrations above the screening level will be deemed to be radioactively contaminated and will require removal and handling of radioactively contaminated soil.

The concentration of Ra-226 in soil will be inferred from the concentration of its progeny Bi-214 using a progeny in-growth method to allow the Bi-214 to approach secular equilibrium with Ra-226. The method requires the sample be hermetically sealed with a 21-day (or longer) hold time before counting. The Ra-226 results will be calculated and reported from the 46.1 percent abundant 0.609 MeV gamma spectrum line of Bi-214 after the in-growth period 21 days.

2.4 SOIL RELEASE CRITERIA

Survey results will be analyzed using the EPA's Office of Solid Waste and Emergency Response (OSWER) *Directive 9200.4-40, Radiation Risk Assessment at CERCLA Sites: Q&A* (U.S. Environmental Protection Agency [EPA], 2014) to determine if the residual radioactivity, distinguishable from background radiation, results in a total effective dose equivalent to an average member of the critical (or screening) group exceeding 12 millirem per year (mrem/yr) or an excess lifetime cancer risk more than 1 x 10^{-4}. The critical group is composed of the individuals reasonably expected to receive the greatest exposure to residual radioactivity within the assumptions of the particular exposure scenario.

3.0 RADIOLOGICAL DATA COLLECTION

Four types of survey and sampling data will be collected: contiguous static measurements, smear samples, gamma scans, and soil (or volumetric) samples. **Exhibit 3-1** summarizes the types of data to be collected from building surfaces and excavations.

Exhibit 3-1. Radiological Data to be Collected from Each Type of Area

Type of Area	Contiguous Statics	Smear Samples	Gamma Scans	Soil Samples
Building/Concrete/Asphalt Surfaces	✓	✓	✓	
Soil Areas/Excavations/Excavated Soil			✓	✓

3.1 DATA QUALITY OBJECTIVES

The EPA's *Guidance on Systematic Planning using the Data Quality Objectives Process* (EPA, 2006) was used to develop data quality objective (DQOs). DQOs are qualitative and quantitative statements developed to define the purpose of the data collection effort, clarify what the data should represent to satisfy this purpose, and specify the performance requirements for the quality of information to be obtained from the data.

3.1.1 Step 1 – Statement of the Problem

The Navy would like to radiologically release building demolition material to be disposed at a Class III landfill as construction debris and confirm that Ra-226 in soil is below its RG.

3.1.2 Step 2 – Decision Statement

The principal study question to be answered by the survey data is: "Is radioactivity present at levels that exceed the release criteria (or screening level)?" Total and removable surface radioactivity measurements and volumetric sample analytical results will be used to answer the question quantitatively.

The following alternative actions result from resolution of the principal study question:

- If the levels of residual radioactivity do not exceed the release criteria (or screening level), then assess whether the dose and risk are no more than 12 mrem/yr and 1×10^{-4}, respectively.
- If the levels of residual radioactivity exceed the release criteria (or screening level), then perform remediation and repeat the radiological survey.

Based on the principal study question and the alternative actions listed above, the decision statement is: "Determine whether or not the levels of residual radioactivity are sufficiently low to meet the release criteria (or screening level)."

3.1.3 Step 3 – Inputs to the Decision

The radionuclides of concern are listed in **Exhibit 2-1**. The impacted media are building materials and exposed excavation surfaces. For building surfaces, alpha/beta contiguous static measurements and samples of removable surface radioactivity (smears) analyzed for gross alpha/beta radioactivity will be used as quantitative inputs. For excavation surfaces, soil samples analyzed by gamma spectroscopy will be used as quantitative inputs. Gamma scans will be used as qualitative inputs.

3.1.4 Step 4 – Boundaries of the Study

The target population is radioactivity concentrations of Ra-226 on and/or in the impacted media. The spatial boundaries include the buildings and their footprints, and excavated surfaces to a depth of 15 centimeters (cm) below the terminal depth of the excavation.

Decisions will be made on three fundamental scales:

- Localized areas: The decision to collect additional data will be made for discrete areas with measurement results that exceed the release criteria.
- Entire building: Each building will constitute a survey unit based on similar physical characteristics and potential for residual radioactivity. A decision will be made for each survey unit as to its suitability for radiological release to unrestricted use or, alternatively, its need for remediation and/or additional data collection.
- Excavations: Survey data will be evaluated on a RA-wide basis to confirm Ra-226 in soil is below its RG or, alternatively, the need for remediation and/or additional data collection.

3.1.5 Step 5 – Decision Rules

The decision rules identified in **Exhibit 3-2** will be used to collect data.

3.1.6 Step 6 – Limits on Decision Errors

To ensure data quality, data will be reviewed, verified, and validated in accordance with the Sampling and Analysis Plan (SAP), included as Appendix A to the Work Plan (Gilbane, 2017). To ensure the usability of laboratory data, appropriate laboratory methods will be selected to provide the necessary laboratory detection limits.

Exhibit 3-2. Decision Rules

Parameter of Interest	IF	THEN	ELSE
Total and Removable Radioactivity	Contiguous static measurements and/or smear samples exceed release criteria	Investigate to determine the area of elevated radioactivity, remediate, and resurvey	Perform dose and risk modeling
Volumetric Radioactivity	Areas identified with measured radioactivity above investigation level	Investigate to determine the area of elevated radioactivity, remediate, and resurvey	Collect soil (or volumetric,) samples
	Soil samples exceed release criteria	Investigate to determine the area of elevated radioactivity, remediate, and resurvey	Perform dose and risk modeling

3.1.7 Step 7 – Optimizing the Survey Design

Steps 1 through 6 of the DQO process above and the SAP describe a resource-effective design for collecting data sufficient to fulfill the design objectives.

3.2 FIELD SURVEY INSTRUMENTATION

Survey data will be collected using the types of field survey instruments (or equivalent) listed in **Exhibit 3-3**. Commercially available radiation detection and measurement instruments were selected based on reliable operation, detection sensitivity, operating characteristics, and expected performance in the field.

Exhibit 3-3. Survey Instruments

Measurement Type	Detector Type	Effective Detector Area and Window Density	Instrument Model	Detector Model
Alpha/beta contiguous statics	Gas-flow proportional	821 cm^2 0.8 mg/cm^2 aluminized Mylar	Ludlum 4612	Ludlum 43-37-1
Alpha/beta smear samples	Gas-flow proportional	5.1 cm diameter 0.08 mg/cm^2	Protean WPC 9550	N/A
	Dual phosphor scintillation	5.1 cm diameter 0.4 mg/cm^2	Ludlum 2929	Ludlum 43-10-1
Gamma scans	NaI scintillation	10 x 10 x 40 cm N/A	RSI RS-700	RSI RSX-1
		5.1 cm diameter/length N/A	Ludlum 2221	Ludlum 44-10

Notes:
cm^2 = square centimeter(s)
mg/cm^2 = milligrams per square centimeter
N/A = not applicable

NaI = sodium iodide

3.2.1 Instrument Calibration and Maintenance

Survey instruments will be calibrated prior to use. Radioactive sources used for calibration will be traceable to the National Institute of Standards and Technology. Instruments will be inspected prior to use to ensure proper working condition, and were properly protected against inclement weather conditions during the operation.

3.2.2 Instrument Response

Instrument response checks will be conducted to assure constancy in instrument response, to verify that the detector is operating properly, and to demonstrate that measurement results are not the result of detector contamination. Instrument response will be checked before instrument use each day data are collected, using a check source that emits the same type of radiation (i.e., alpha, beta, and/or gamma) as the radiation being measured and that gives a similar instrument response. The response check is performed at a set location using a specified source-detector alignment that can repeated easily.

Prior to initial instrument use and unless otherwise called for in specific work instructions, 20 measurements will be taken using a source representative of the radiation types and energies of interest. The same number of measurements also will be taken with the source removed to determine the instrument’s expected response to ambient background. Background will be monitored qualitatively to assess daily variations that may impact the instrument’s minimum detectable concentration (MDC).

3.2.3 Alpha/Beta Detection Sensitivity

Typical alpha/beta detection sensitivities of field survey instruments are shown in **Exhibit 3-4**. The values are based on assumed count times, background counts, and total efficiencies. Instrument-specific values based on actual field conditions will be used to establish *a priori* MDCs before the instruments are used to ensure that each instrument is capable of detecting radiation at or below the release criteria. The MDC is the concentration that a specific instrument and technique can be expected to detect 95 percent of the time under actual conditions of use. It is calculated using the methods found in **Attachment 1**. The calculation of the MDC may be modified to accommodate project-specific applications.

Exhibit 3-4. Typical Alpha/Beta Detection Sensitivities

Detector Model	Radiation of Interest	Count Time (minutes)	Background (cpm)	Total Efficiency[a] (cpm/dpm)	MDC[b] (dpm/100 cm^2)
Ludlum 43-37-1	Alpha	1	7	0.05	29
	Beta	1	1,400	0.13	121
WPC 9550	Alpha	1	1	0.10	92
	Beta	1	160	0.15	615
Ludlum 43-10-1	Alpha	2	1	0.20	17
	Beta	2	40	0.22	141

Notes:
[a] Total efficiency equals instrument efficiency multiplied by surface efficiency; alpha = 0.25, beta = 0.5.
[b] MDC is calculated in accordance with **Attachment 1**.
cpm = counts per minute
dpm = disintegrations per minute

Total efficiency values for the detection of alpha/beta-emitting surface radioactivity will be developed using International Organization for Standardization (ISO) 7503-1, *Evaluation of surface contamination – Part 1: Beta-emitters (maximum beta energy greater than 0.15 MeV) and alpha-emitters* (ISO, 1988). ISO 7503-1 defines total efficiency (ε_T) as the product of two terms: the instrument efficiency (ε_i) and the surface efficiency (ε_s).

Equation 3-1

$$\varepsilon_T = \varepsilon_i \times \varepsilon_s$$

The instrument efficiency is determined based on an average rate of particles detected by the instrument relative to the surface (2π) particle emission rate of the calibration source. The surface particle emission rate is a value measured and certified by the source manufacturer.

The surface efficiency (ε_s) is determined based on the rate of particles emerging from the surface of interest in the field relative to the rate of particles being generated from the total (4π) activity present on the surface. Optimally, the surface efficiency is an experimentally determined value specific to the field surface that accounts for its backscatter characteristics as well as geometry influences (e.g., a scabbled concrete surface). In the absence of an experimentally determined value, the following values recommended in ISO 7503-1 are used:

- 0.25 for alpha emitters and beta emitters with a maximum beta energy between 0.15 MeV and 0.4 MeV, and
- 0.5 for beta emitters with maximum beta energy greater than 0.4 MeV

3.3 CONTIGUOUS STATIC MEASUREMENTS

Contiguous static measurements will be performed on building surfaces to detect and quantify alpha/beta surface radioactivity. Contiguous static measurements are neighboring measurements of surface radioactivity that share proximity in both space and time, i.e., they are collected spatially near one another and at about the same time, with each measurement performed at a discrete location for a fixed count time.

3.3.1 Methodology

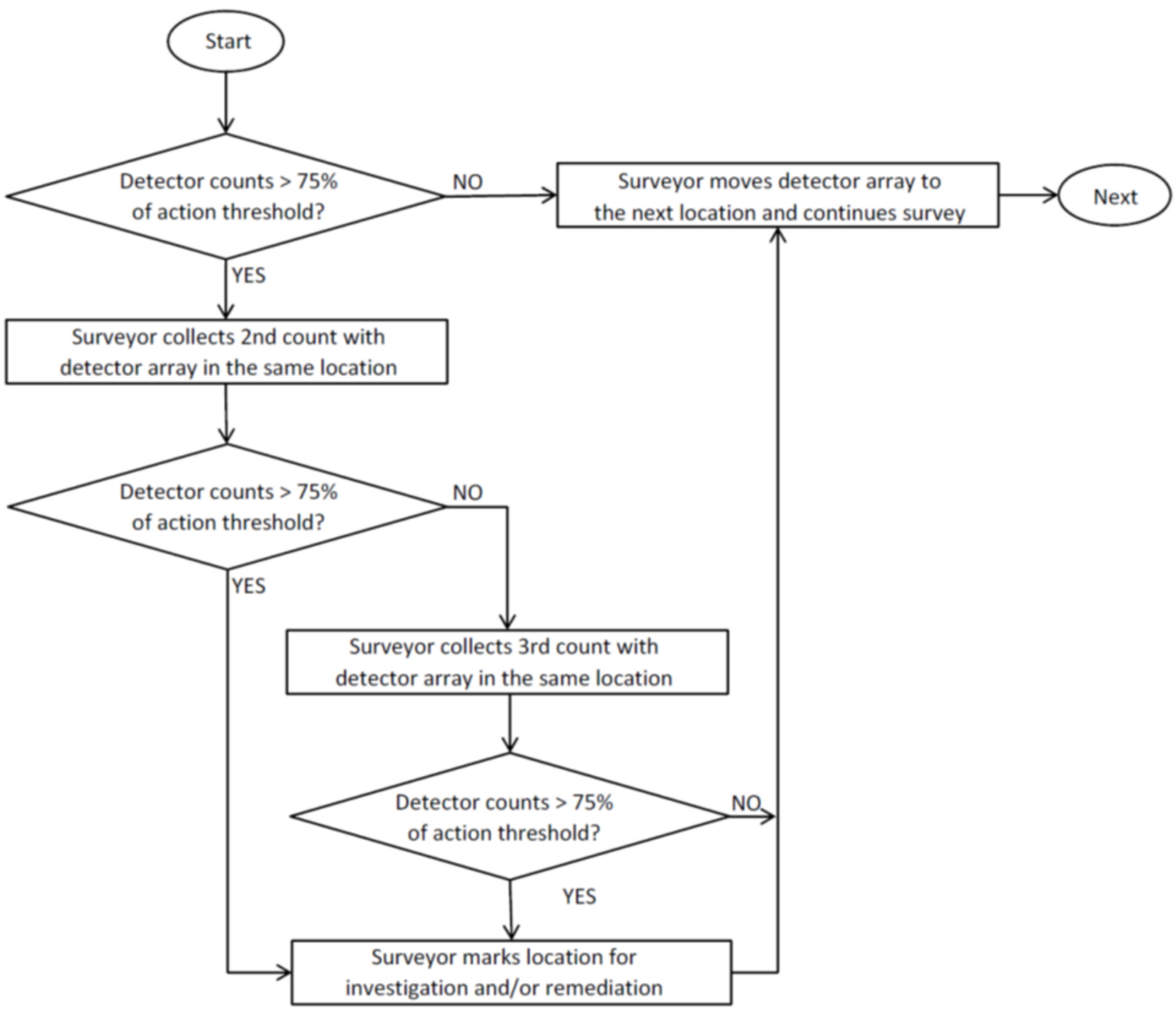
The process outlined in the *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM; U.S. Department of Defense [DoD] et al, 2000) relies on scanning to provide a level of confidence that no areas of elevated residual radioactivity (i.e., radioactivity above the release criteria) remain that may have been missed by static measurements collected from across a survey unit. A technical basis for using contiguous static measurements in lieu of scanning which MARSSIM (DoD et al, 2000) relies on is found in **Attachment 2**.

Contiguous static measurements will be performed using an array of six Ludlum Model 43-37-1 821 cm^2 gas-flow proportional detectors coupled to a Ludlum Model 4612 12-channel counter. The Ludlum Model 43-37-1 detectors are mounted side-by-side lengthwise in a 3 x 2 configuration on a frame measuring approximately 58 cm by 136 cm. The detector array is placed on the surface to be measured and a count is collected. The detector array is then moved to the next measurement location and the process repeated until contiguous statics have been collected across the entire survey coverage area.

Twelve individual counts – two per detector (one alpha and one beta) - are captured along with a date/time stamp for each count. If any detector registers counts exceeding the investigation level, it is flagged and 2-out-of-3 logic is applied as shown in **Exhibit 3-5**.

Locations where the detector counts exceed the investigation level 2 of out 3 times will be marked for further assessment and/or remediation. The detector array will be moved to the next measurement location and the process repeated until contiguous static measurements have been collected across the entire survey coverage area.

Exhibit 3-5. Diagram Showing 2-Out-of-3 Logic



3.3.2 Effective Survey Coverage

The detector array covers a surface area of approximately 1.0 square meter (m^2). However, approximately 40% of the surface area covered by the detector array is outside a detector window (i.e., active area). In other words, only 60% of the surface area covered by the detector array is within the active area of a detector. So, taking measurements at a sequential spacing of one detector array-width results in an effective survey coverage of 60%, which is more than sufficient coverage for a Class 3 survey unit. A lower survey coverage is achieved by increasing the spacing between detector array positions for each subsequent measurement. A higher survey coverage as would be needed for a Class 1 survey unit is achieved by offsetting the detector array position as described in Attachment 2.

Survey coverage will be established by a series of grid locations at which continuous static measurements will be collected. Each of the 12 individual counts collected at each location will be assigned a unique identifier relative to the detector position within the detector array. In this manner each measurement can be traced to a finite survey location.

3.3.3 Equivalent Static Measurements

The process described in MARSSIM (DoD et al, 2000) relies on a statistically significant number of static measurements collected from both random and systematically-spaced locations to demonstrate compliance with the release criteria. Typically this results in 10, 20, or even 30 static measurement locations per survey unit. Contiguous static measurements not only can be used in lieu of scanning, but also may be used as static measurements to demonstrate compliance with the release criteria since they are discrete measurements performed at finite locations.

The detector array yields measurement results for a total of six equivalent static measurement locations – one per detector – over each approximate 1.0 m^2 surface area.

3.3.4 Small Area Coverage

A single Model 43-37-1 detector will be used to perform contiguous static measurements in small or tight areas where the detector array cannot be used effectively (e.g., ledges, corners, irregularly shaped surfaces). The same measurement methodology will be used, including the detector offset method where the survey coverage requirement is greater than 60%.

3.4 SMEAR SAMPLES

Smear samples will be collected from building surfaces to detect removable alpha/beta surface radioactivity. A single smear sample will be collected randomly within the spatial footprint of the detector array at each contiguous static measurement location. Additional smear samples may be collected at biased locations within the spatial footprint of the array as appropriate.

Smear samples will be collected over approximately 100 cm^2 and analyzed for alpha and beta radioactivity using a Protean WPC 9550 gas-flow proportional alpha/beta counting system (or equivalent), using a count time of one minute or longer to meet the required MDC. Field counting of samples may be performed using a Ludlum Model 43-10-1 dual phosphor scintillation detector (or equivalent) with a Ludlum Model 2929 alpha/beta scaler (or equivalent). Data will be reported in units of dpm/100 cm^2 or dpm/smear.

3.5 GAMMA SCANS

Gamma scans will be performed of the excavations and excavated soil to locate radiation anomalies (i.e., irregularities) that might indicate areas of volumetric surface or subsurface radioactivity that warrant further investigation. Gamma scans also will be performed on selected non-concrete/asphalt surfaces surrounding the perimeter of buildings to identify any potential sources of interference during the interior and exterior building surveys, or other potential worker exposure concerns. Gamma scans will be performed using a Radiation Solutions, Inc. (RSI) RS-700 self-contained mobile gamma-ray detection system. The RS-700 consists of a digital gamma-ray spectrometer/multi-channel analyzer coupled to a 10 cm by 10 cm by 40 cm sodium iodide (NaI) gamma scintillation detector. Custom-built copper-lined lead shielding with a steel surround encases the top and sides of the detector. The shielding focuses the detection capability on radiation coming from the ground, i.e., forces the detector to "scan downward," optimizing the detection of gamma-rays at surface or near-surface locations. The RS-700 automatically captures and position-correlates the scan data at one-second intervals by means of a global positioning system mounted to it.

3.5.1 Physical Configuration

The RS-700 is either pulled behind a small tractor for screening excavated soil on a laydown pad, or is mounted either vertically or horizontally on an engine-powered telescopic boom lift for scanning excavation floors and sidewalls without worker entry into the excavation. The detectors are mounted at a height of 10 cm above the surface and moved over the surface at a speed of 0.5 meters per second (m/sec), with each pass spaced approximately 0.5 m from the previous pass (center line to center line) to assure 100 percent coverage of the area being surveyed is achieved. Changes to the scan height or scan rate may be made to optimize detection response while accommodating field conditions.

Smaller areas that cannot be surveyed using the RS-700 system will be scanned using a hand-held Ludlum Model 44-10 2x2 NaI gamma scintillation detector with a Ludlum 2221 rate meter/scaler (or equivalent).

3.5.2 Regions of Interest

The gamma scan data are collected and analyzed by regions of interest (ROIs) that are pre-programmed prior to the start of data collection. The RS-700 collects photon energy response over 1,024 channels, with each channel representing an energy band of approximately 3 kil-electron volts (keV). Each ROI consists of a selected subset of the RS-700 data focused around a specific peak of interest in the energy spectrum. **Exhibit 3-6** lists the ROIs, the window range for each ROI, and the peak of interest. The channel-to-energy conversion is one channel equals 3 keV. The ROIs are based on International Atomic Energy Agency (IAEA) Technical Report 323, *Airborne Gamma-Ray Spectrometer Surveyin*g (IAEA, 1991).

Exhibit 3-6. RS-700 Data Regions of Interest

ROI	ROI Name	Channel		Energy (keV)		Basis/Discussion
		Start	End	Start	End	
02	Potassium	457	523	1371	1569	based on K-40 1461 keV peak (IAEA setting)
03	Ra-226 (1764)	553	620	1659	1860	based on progeny Bi-214 1764 keV peak (IAEA setting)
06	Ra-226 (609)	182	222	546	666	based on progeny Bi-214 609 keV peak
10	Gross Counts	1	1024	3	3072	based on full channel (i.e., total gamma) spectrum

The ROIs are set to measure windows centered on the gamma emissions of radionuclides of concern or one of their more detectable progeny. Potassium [ROI 02] is naturally occurring potassium-40 (K-40) and is not a radionuclide of concern; however, it is used to characterize the variability of the background. Radium [ROIs 03, 06] is naturally occurring, but may be present in anthropogenic form. The Ra-226 (609) [ROI 06] and Ra-226 (1764) [ROI 03] regions are used to evaluate the presence of Ra-226 by measuring the gamma radiation emitted by the Ra-226 progeny Bi-214. The Compton continuum of the 1461 keV K-40 peak contributes to the Ra-226 (609) and is not compensated for. Therefore, where elevated potassium [ROI 02] counts are found, the Ra-226 (609) [ROI 06] counts are elevated, but the Ra-226 (1764) [ROI 03] counts are not affected.

3.5.3 Contour Mapping

Contour maps will be created using the RS-700 data to aid in field investigations as well as to facilitate the selection of biased measurement locations. The contour maps aid in identifying variations in detected radioactivity and assessing spatial patterns in the data including finite locations that may represent discrete ROs. The mean and standard deviation of the data set are calculated and used to develop color-coded contour maps based on z-score values (i.e., the number of standard deviations each measurement lies from the mean). The contouring process involves creating a regularly spaced grid and assigning values to every spot on the grid. Grid node values are assigned using a weighted average based on the inverse square law, which describes how radiation levels drop off with distance from a source. Once the grid is complete, color-coded contours are created from grid node values within the specified ranges of values. The contouring process tends to smooth over single data points with lower sigma values while accentuating clustered areas or single locations with higher sigma values. This is the desired effect which aids in the data analysis by focusing attention on those areas most likely to contain discrete radioactivity.

3.5.4 Field Investigation

As a general rule, areas with a z-score of 3.0 or higher will be identified by coordinates and investigated. The investigation area will be approximately 3 meters (m) by 3 m centered on the coordinates of the suspect area. At the location of the highest reading, small portions of sediment will be scooped out from the elevated location and moved to a laydown/sorting area. The sediment will be spread out in a thin layer and scanned. Count rates in the hole being dug and of sediment being removed will be monitored. The process of scooping, spreading out, and scanning the sediment will continue until an RO is recovered, it is determined that a discrete item cannot be readily located, or the cause for the elevated reading is otherwise determined. The Navy will be consulted where more extensive actions may be required.

Identified ROs and immediately surrounding soil will be removed using hand tools and the area resurveyed. The radioactive material will be collected, segregated, and stored in appropriate containers.

3.6 SOIL SAMPLES

Soil samples will be analyzed for the COCs, including Ra-226. The sample data will be used as definitive data to confirm the RG for Ra-226 in soil is met. Samples will be collected at a frequency and at representative locations throughout the survey unit such that a statistically sound conclusion regarding the radiological condition of the survey unit can be developed. A minimum of 20 samples per survey unit will be collected. Pre- and post-sample gamma static readings will be collected where practical and safe to do so.

3.6.1 Number of Samples

MARSSIM (DoD et al, 2000), Section 5.5.2.2, describes the method for determining the number of samples necessary to assure a population of sufficient size for statistical analysis. The method defines a gray region as the range of uncertainty regarding the true mean of the sample population. The width of the gray region is the difference between the upper bound of the gray region (UBGR) and the lower bound of the gray region (LBGR). Setting the background contribution to zerio, the LBGR can be set equal to zero and the UBGR set equal to the release criterion. The concentration to be measured relative to the variability in the concentration determines the number of samples needed. The ratio is referred to as the relative shift, denoted by Δ/σ.

Equation 3-2

$$\Delta/_{\sigma} = \frac{UBGR - LBGR}{\sigma}$$

where:

UBGR = upper bound of gray region (= release criterion)
LBGR = lower bound of gray region (= 0)
σ = standard deviation or variability in the measured concentrations

MARSSIM (DoD et al, 2000) states that relative shift values greater than 3.0 will not result in significant changes in the number of samples required to support a decision. Based on a relative shift (Δ/σ) of 3.0 and false positive and false negative decision error rates (i.e., Type I (α) and Type II (β), respectively) of 0.05 (i.e., 95% confidence level), MARSSIM (DoD et al, 2000) Tables 5.3 and 5.5 provide the number of measurements required to support a decision using one of two statistical tests. Regardless of the statistical test applied, using 20 as the minimum number of samples provides a statistically sufficient number of samples to support a decision.

3.6.2 Sample Locations

A random-start systematic pattern will be used to identify sample locations. The starting point will be determined by a random selection process, and successive sample locations will be distributed around the starting point in a systematic pattern across the survey unit. Up to five samples also will be collected at biased locations identified for further investigation by gamma scans. This ensures data are collected from suspected areas that might otherwise be missed through the systematic sampling process and provides a better indication of the maximum concentrations of radionuclides of concern that are present.

3.6.3 Supplemental Samples

Volumetric samples of concrete or other materials may be collected for laboratory analysis where volumetric radioactivity is suspected to be present and/or additional qualitative information regarding its form and/or isotopic composition is desired.

3.6.4 Sampling and Analysis

Sampling and analysis will be performed in accordance with the SAP. Except where available material to sample is limited, samples collected will be approximately 1,000 grams in size. Visually identifiable foreign objects and debris will be separated manually in the field. Sampling equipment (e.g., hand and power tools, mixing utensils, and homogenizing bowls) will be decontaminated (using dry methods) between samples to prevent cross-contamination of sample media. Samples will be double bagged in one-gallon re-sealable plastic bags, numbered, logged, and sent for laboratory analysis. Each sample will be labeled and assigned a unique sample identification number. A contamination survey of the sample container will be performed prior to shipment.

Samples will be turned over to the laboratory using proper chain-of-custody procedure. Once received by the laboratory, samples will be prepared by drying, grinding, mixing, sifting, and weighing as appropriate prior to analysis in accordance with the SAP. The laboratory will be accredited under the DoD Environmental Laboratory Accreditation Program and the California State Environmental Laboratory Accreditation Program.

Samples will be analyzed by gamma spectroscopy. The concentration of Ra-226 will be inferred from the concentration of its progeny Bi-214 using a progeny in-growth method to allow the Bi-214 to approach secular equilibrium with Ra-226. The method requires the sample be hermetically sealed with a 21-day (or longer) hold time before counting. The Ra-226 results will be calculated and reported from the 46.1 percent abundant 0.609 MeV gamma spectrum line of Bi-214 after the in-growth period 21 days. Radiological data will be reported in pCi/g dry weight, along with estimated total propagated uncertainty and MDC.

3.7 REFERENCE AREAS

There may be data sets for which a reference area is required in order to appropriately assess the data. A background reference area should have similar physical, chemical, geological, radiological, and biological characteristics as the survey unit being evaluated. Reference areas are normally selected from non-impacted areas, but are not limited to natural areas undisturbed by human activities. In some situations, a reference area may be associated with the survey unit being evaluated, but it cannot be potentially contaminated by site activities. Ideally, the radioactivity present in a reference area would be the same as the radioactivity present in the survey unit had it never been radiologically impacted.

For purposes of continuity, the same reference area(s) used for previous work at Treasure Island will be used for work this project wherever possible. They will be qualified and, if suitable, used to develop representative radionuclide background concentrations. If none are found to be suitable, potential reference areas having physical and radiological characteristics similar to those of the impacted area(s) being evaluated will be identified and their use concurred with by the Navy.

3.8 REFERENCE COORDINATE SYSTEM

A reference coordinate system, or grid system, will be used to facilitate the selection of measurement locations and to provide a mechanism for referencing a measurement to a specific location so that the measurement location can be relocated. Scale drawings, maps, or photographs of the survey area will be prepared and oriented according to the reference coordinate system. The reference coordinate system is intended primarily for reference purposes and does not necessarily dictate the actual spacing or location of measurements.

4.0 RADIOLOGICAL DATA ANALYSIS

Survey data will be collected according to the DQOs and are both quantitative and qualitative in nature. Data will be assessed quantitatively for direct comparison to the release criteria, and will be reviewed qualitatively to determine whether further investigation is appropriate.

4.1 DATA VALIDATION AND VERIFICATION

Survey data will be reviewed to verify that they are authentic, appropriately documented, and technically defensible. The review criteria for data acceptability are as follows:

- The instruments used to collect the data are capable of detecting the radiation types and energies of interest at or below the release criteria.
- The calibration of the instruments used to collect the data is current, and the radioactive sources used for calibration are traceable to the National Institute of Standards and Technology.
- Instrument response is checked before instrument use each day.
- The MDCs and the assumptions used to develop them are appropriate for the instruments and the survey methods used to collect the data.
- The survey methods used to collect the data are appropriate for the media and types of radiation being measured.
- The custody of samples collected for laboratory analysis is tracked from the point of collection until final results were obtained.

Where one or more of the criteria are not met, the discrepancy will be reviewed, and the reasons for acceptability of the data or the corrective actions taken to restore data acceptability will be documented.

4.2 NUMERICAL DATA REVIEW

Contiguous static measurements and soil sample results will be compared to the release criteria. Statistical quantities (range, median, mean, and standard deviation) will be calculated. The presence and significance of outliers in the collected data sets will be assessed. Statistical analyses may be performed to identify trends, groupings, and outliers in the data population.

4.3 GRAPHICAL DATA REVIEW

Survey data will be graphed to identify patterns, relationships, or potential anomalies in the data that might go unnoticed using purely numerical methods. Multiple methods will be used to reveal characteristics of the data distribution that may not be apparent with other methods.

Graphical methods may include a posting plot, box-and-whisker plot, frequency plot, and/or cumulative distribution diagram constructed for each data set. Other graphical data representation tools may be used, as appropriate, in addition to or in lieu of those described here.

4.3.1 Posting Plot

A posting plot is used to identify spatial patterns in the data. A posting plot is simply a map of the survey unit with the data values entered at the measurement locations. The posting plot can reveal spatial inhomogeneities in the survey unit such as patches of elevated radioactivity or groupings of measurements that exceed the release criteria. It can also reveal spatial trends in data that may be due to inhomogeneities in the survey unit background material.

4.3.2 Box-and-Whisker Plot

A box-and-whisker plot is used to provide insight into the location, shape, and spread of the data. The bottom and top of the box represent the first and third quartiles, and the line inside the box represents the second quartile (the median) of the respective dataset. The ends of the whiskers represent the minimum and maximum values of the data still within 1.5 times the interquartile range (i.e., the difference between the first and third quartiles). Maximum or minimum values outside that range are shown as outliers. Where there is more than one outlier, only the maximum or minimum value is shown.

4.3.3 Frequency Plot

A frequency plot is used to examine the general shape of the data distribution. Such plots may reveal any obvious departures from symmetry, such as skewness or bimodality (two peaks), in the data distribution. When the data distribution is highly skewed, it may be result of dissimilar populations or, often, because there are a few areas of elevated radioactivity. The presence of two peaks in the data may indicate the existence of isolated areas of elevated radioactivity or a mixture of background distributions due to different soil types, construction materials, etc.

4.3.4 Cumulative Frequency Plot

A cumulative frequency diagram is used to provide information on the general shape of the data distribution and to identify data points that do not follow the general data distribution. The diagram is constructed assuming normally distributed data, which when plotted form a straight line. A sharp bend in the plotted data indicates the possibility of multiple distributions, and outliers show up as individual points separate from the rest of the distribution. Such anomalies indicate dissimilarity in the data, as would be present with radioactive contamination.

4.4 DOSE AND RISK MODELING

Dose and risk levels for the critical group will be derived by analyzing residual levels of radioactive materials using exposure scenarios modeled using RESRAD-ONSITE (formerly known simply as RESRAD) and RESRAD-BUILD. RESRAD-ONSITE and RESRAD-BUILD are software codes developed by Argonne National Laboratory (ANL) for the U.S. Department of Energy (DOE) and the NRC to evaluate radioactively contaminated sites. They are designed to analyze radiation doses from residual radioactivity using various pathways and scenarios (i.e., direct radiation, inhalation, ingestion) through which exposures could occur.

The radiological exposure model translates residual radioactivity levels into potential radiation dose (and risk) to the reasonably maximally exposed member of the public. The model initially defines the exposure scenario and the exposure scenario subsequently defines the critical group and establishes the major exposure pathways of direct exposure to penetrating radiation and inhalation and ingestion of radioactive materials. The exposure scenario and associated modeling are specifically designed to be "reasonably conservative" by generally overestimating potential dose.

4.4.1 Building Occupancy Scenario

For buildings, the computer modeling software RESRAD-BUILD for Windows, Version 3.5 (ANL, 2009) will be used to calculate a hypothetical dose and risk to members of the general public based on a building occupancy scenario. The methodology and assumptions that will be used are found in **Attachment 3**. The building used in the dose model is conceptualized as a single-room structure. The dose receptor is assumed to be a person standing on the floor in the center of the room. The room is assumed to be uniformly contaminated on the floor and lower walls (wall surfaces less than 2 m above the floor). No contamination is assumed on the upper walls or ceiling. The radioactive source is assumed to be Ra-226.

The dose model accounts for exposure to both fixed and removable thin-layer surface radioactivity via a series of six exposure pathways. The RESRAD-BUILD default parameters will be used with the exception of the removable fraction, which will be limited to 20% of the total surface radioactivity as specified in **Section 2.2**.

4.4.2 Suburban Resident Scenario

For excavations, the computer modeling software RESRAD-ONSITE for Windows, Version 7.2 (ANL, 2016) will be used to calculate a hypothetical dose and risk to members of the general public based on a suburban resident scenario. The methodology and assumptions that will be used are found in **Attachment 4**. The residential environment used in the dose model is conceptualized as a contaminated area of surface soil with a house on it. The dose receptor is assume to be a person that lives in the house and spends time both indoors and outdoors, but does not ingest any water, meat, milk, or food from onsite sources. Existing land use and activity restrictions at NAVSTA TI prohibit the consumption of food grown onsite. The radioactive source is assumed to be the net activity concentrations above background of the radionuclides of concern.

The dose model accounts for exposure to radioactivity via a series of three exposure pathways: external exposure, inhalation of dust, and ingestion of soil. The RESRAD-ONSITE default parameters will be used with the exception of the contaminated area and the distance of the length of the contaminated area parallel to the aquifer. Actual survey unit surface area values will be used.

5.0 BUILDING SURVEY, REMEDIATION, AND DEMOLITION

A radiological survey will be performed of each building to be demolished and a report prepared to document the survey results and conclusions regarding the suitability of the building for radiological release to unrestricted use. Once the report has been accepted by the Navy and the California Department of Public Health (CDPH) Radiologic Health Branch, hazardous waste materials will be removed, the building will be demolished, and the materials disposed as construction debris.

5.1 SITE PREPARATION

To minimize neighborhood disruption, gated access to the building demolition sites will be off of Gateview Avenue directly rather than through side streets or parking areas. Before starting work in a building, the utilities will be verified to have been disconnected (air gaps and zero power/energy sources). Trash and debris will be radiologically screened and removed from the buildings. Carpeting will be removed to expose flooring surfaces beneath and radiologically screened. Any remaining appliances will be radiologically screened and removed from the buildings. Smoke detectors and “Range Queen” fire suppressant systems will be uninstalled and secured within the buildings for subsequent transfer to the Navy’s LLRW contractor.

5.2 BUILDING SURVEY

Building and associated storage or utility shed surfaces will be radiologically surveyed equivalent to a MARSSIM Class 3 survey unit to support unrestricted release and disposal of the building construction materials as non-contaminated construction debris. A Class 3 area is defined as a radiologically impacted area where activities involving radioactive material may have occurred.

5.2.1 Data Collection

A gamma scan will be performed over a 2-m wide area on non-concrete/asphalt surfaces surrounding the perimeter of the building to identify any potential sources of interference during the interior and exterior building surveys, or other potential worker exposure concerns. A field investigation may be performed and soil samples collected at biased locations identified for further investigation by gamma scans.

Contiguous static measurements will be collected to measure total surface alpha/beta surface radioactivity. Measurements will be collected from building interior floor and interior/exterior wall surfaces from ground level to a 2 m height. The survey coverage will consist of randomly selected locations and at areas of highest potential for elevated radioactivity (e.g., door entry ways, areas around light switches, ventilation openings, etc.) selected based on professional judgment covering approximately 10 percent of accessible surface area. This provides a qualitative level of confidence that no areas of elevated radioactivity are missed.

Smear samples will be collected from building surfaces to detect removable alpha/beta surface radioactivity. A single smear sample will be collected randomly within the spatial footprint of the detector array at each contiguous static measurement location.

5.2.2 Survey Report

A report will be prepared to document the results of the radiological survey and sampling performed of each building. The report will include survey and sampling data, numerical and graphical analyses of the data, and conclusions. The report will include dose and risk modeling demonstrating that residual radioactivity, if any, will not result in members of the general public being exposed to unacceptable levels of radiation or radioactive materials.

The report will be submitted to the Navy and the CDPH Radiologic Health Branch for concurrence that building materials are radiologically released for unrestricted use and are suitable for disposal as construction debris at a Class III landfill.

5.3 PRE-DEMOLITION ACTIVITIES

The Bay Area Air Quality Management District will be notified of the building demolition at least 10 days prior to beginning demolition activities by submittal of a Demolition Notification Form in accordance with Regulation 11, Rule 2 (1998). Because the building and surrounding land are federal property and the work is conducted under the Comprehensive Environmental Response, Compensation, and Liability Act, no city or county demolition permits or fees are required.

5.3.1 Perimeter Fencing

Where permanent fencing does not currently exist, temporary chain-link fencing will be installed around each building designated for demolition. The fence will maintain site control and gates within it are sufficiently large to allow entry/exit of heavy equipment and personnel for radiological survey, asbestos and lead paint abatement, and demolition activities. This fencing will be maintained as required during demolition of these buildings and subsequent activities. Signs will be posted with the following information: "Danger Construction Zone, Unauthorized Personnel Keep Out", or similar.

5.3.2 Building Clean-Out

Universal waste, such as fluorescent lamps and tubes, mercury switches, and batteries, will be removed from the building prior to demolition and will be packaged, labeled and disposed or recycled in accordance with California's Universal Waste Rule, 22 CCR 23. Smoke detectors that contain radioactive materials will be removed from the buildings and will be segregated from other materials for disposal. These items will be transported and disposed of separately from the building demolition debris.

Large appliances, if present, will be surveyed and removed from the building for recycle. Prior to removal, refrigerant (e.g., Freon) will be removed from refrigerant-containing appliances such as refrigerators or air conditioning units by a certified refrigerant recovery contractor. Other hazardous household materials such as mercury-containing thermostats will be removed and staged for appropriate disposal.

Carpeting and other debris that may be present will be radiologically screened and removed to allow for access to the floor below for survey. These materials will be staged and disposed with the construction debris following building demolition.

5.3.3 Asbestos and Lead-Based Paint Abatement

Asbestos-containing material (ACM)/lead-based paint (LBP) abatement will be performed by a licensed contractor in preparation for building demolition. An ACM/LBP abatement plan will be prepared by the subcontractor in accordance with the *Safety and Health Requirements Manual* (U.S. Army Corps of Engineers, 2014) and reviewed and accepted by Gilbane and the Navy. Subcontractor employees performing ACM/LBP abatement work will be required to complete a site hazard briefing provided by Gilbane during mobilization. During the asbestos abatement, a licensed independent contractor will perform third-party asbestos air monitoring; the air monitoring subcontractor will also complete a site hazard briefing prior to beginning work at the buildings. Waste will be packaged, transported, and disposed by the asbestos contractor. If required, access corridors may be constructed to support ACM/LBP abatement activities.

Prior to beginning asbestos abatement, paint chip samples will be collected for lead analysis at an off-site laboratory. Areas of loose and peeling paint and confirmed LBP (e.g., painted window sills) will be removed from the building prior to demolition. The LBP waste will be disposed separately from the building demolition debris.

5.3.4 Utility Abandonment/Protection

The buildings addressed by this RMDP are no longer in use, and utilities are out of service. Gilbane will coordinate with local utilities to ensure that all power lines and other utility lines leading into the buildings and their associated footprint are disconnected prior to beginning demolition. The temporary power source to be used during radiological survey activities and asbestos abatement will be removed from the buildings upon completion of that work.

The locations of natural gas lines in the vicinity of buildings subject to demolition will be reviewed with San Francisco Public Utilities Commission to determine line capping requirements prior to demolition activities. Cut and capped utilities will be marked on as-built drawings, as appropriate.

5.3.5 Pre-Demolition Engineering Survey

Prior to demolition, an engineering survey will be completed by a registered California engineer per EM-385-1-1 Section 23.A.01 (USACE, 2014). The engineering survey will include a structural inspection and evaluation of the buildings to identify safety hazards that may be encountered during demolition activities. The engineering survey report will document the inspection findings as well as summarize the asbestos and lead testing and abatement activities.

5.4 DEMOLITION

The building demolition will be performed under the supervision of a Gilbane designated demolition competent person or a project engineer. Only necessary personnel (e.g., equipment operator and laborers) will be allowed in the exclusion zone established for demolition activities. No personnel will be allowed to enter any building during demolition activities. Equipment operators participating in the building demolition will have been certified and designated operators of on-site equipment in accordance with Gilbane procedures.

5.4.1 Ingress/Egress Corridor Construction

In order to provide a clean corridor for personnel and equipment to conduct ACM/LBP abatement, building demolition, and debris removal, a built-up temporary roadway will be constructed as required employing chemically and radiologically acceptable and pre-qualified import fill material. The temporary roadway is to keep construction vehicles on a clean surface.

Stockpile areas will be established adjacent to demolished buildings. Access routes will be established from the building sites to the stockpile areas. The temporary roads will be maintained as a clean corridor and no personnel or equipment using the roads will be allowed access to a restricted area, and personnel or equipment in an adjoining restricted area will not be allowed access to the temporary road. Where possible, demolition debris will not be transported on public roadways to stockpile areas.

The areas where material is placed for construction of a temporary roadway or working pad will be returned to current grade once it is no longer in use.

5.4.2 Demolition of Structures

Demolition will remove building materials above the concrete slab foundation. If demolition of a building takes more than 1 day, a structural inspection will be performed at the start of each additional day of work to ascertain the building's condition and possible associated safety hazards, in addition to ensuring that there are no occupants. The building inspector will not enter the building to perform the inspection.

An exclusion zone around building and stockpile area, including a clean working corridor for moving the construction debris, will be established prior to demolition. Demolition will begin once abatement activities are complete and the Navy concurs the remaining building material may be disposed as non-contaminated construction debris. An excavator with a thumb and bucket (in conjunction with dust mitigation equipment) will be used to demolish the buildings.

The bucket will be used to partially collapse the roof sections. The exterior wall sections will then be pushed inward by the excavator. In like manner, the remaining building walls and carports will be “folded” inward to limit the debris field to the slab and the immediate area. The excavator (bucket and thumb) will be used to load the debris into high board trucks for subsequent transport and landfill disposal.

The demolition of the storage sheds, carports, fencing, and other appurtenances will occur with the demolition of the building. After the building structure has been demolished, the debris will be broken down into smaller pieces and direct loaded into trucks for transport and disposal off site as construction debris.

5.4.3 Dust Control

Dust suppression activities will be performed using hoses and applying water on the area of each building being demolished. Water for dust suppression activities will be supplied by hose from available fire hydrants or from a water truck situated adjacent to the building. If a fire hydrant is used, a City of San Francisco water meter will be attached to the hydrant and the water will be routed through the meter into a hose.

5.4.4 Disposal of Building Debris

After the building has been demolished, the resulting debris will be located on the concrete slab foundation of the building or in designated stockpile areas. Using an excavator and loader (or equivalent), the debris will be sized according to the disposal facility acceptance criteria and loaded for transportation and disposal off site as construction debris.

For truck movements, a spotter will be used for health and safety purposes. The truck(s) will be backed down the temporary roads adjacent to the demolished buildings to the location of the debris. Once loaded, the truck(s) will return out using the temporary road. This process will continue until the debris is removed.

5.4.5 Foundation Survey and Removal

Following removal of building structural materials, concrete building foundations and associated adjacent concrete or asphalt materials (such as carports, sidewalks, and patios) will be radiologically surveyed (e.g., gamma scans, smear samples, etc.) to support proper waste characterization or reuse, and then will be removed and stockpiled. The top side will be radiologically surveyed equivalent to a MARSSIM Class 3 survey. The concrete slab or asphalt material will be saw cut or broken up, flipped, and the underneath side surveyed in a manner equivalent to a MARSSIM Class 1 survey since it is the surface in contact with soil and may be radioactively contaminated based on soil conditions. The MARSSIM Class 1 classification means survey coverage will be increased to 100 percent. Supplemental volumetric samples of the concrete and asphalt materials may also be collected for analysis to support waste characterization or reuse. Concrete, asphalt, and foundation support materials determined to be non-LLRW will be stockpiled pending off-site transport and/or potential re-use following coordination with the Navy.

6.0 EXCAVATION SURVEY AND SAMPLING

In order to confirm that Ra-226 in soil is below its RG and to support the overall goal of obtaining additional lines of evidence to support the IR Site 12 radiological CSM, radiological data representative of post-remedial action or “as-left” conditions of each excavation will be collected.

6.1 SITE PREPARATION

Prior to initiating excavation activities, an RCA will be set up around the area to be excavated. The RCA will be sized so that work can be conducted with minimal disruption, but also to minimize the impact on residential activities in the area (e.g., street traffic, pedestrians, bus stops, etc.). The RCA will be configured based on excavator clearances, truck access, and staging areas that may be needed for material and equipment. Wherever possible, heavy equipment will remain outside the RCA, limiting possible contamination to the excavator arm/bucket and the dump bed of the truck. A conditional RCA will be established around the dump truck during loading activities and released once loading activities are completed. Where warranted, radiological postings will be positioned so as to be visible to workers in accordance with radiation protection requirements.

6.2 SOIL EXCAVATION

A gamma scan of the area to be excavated will be performed prior to soil disturbance to identify any radiological issues that may exist or other potential worker exposure concerns. A field investigation may be performed and soil samples collected at biased locations identified for further investigation by gamma scans.

Excavated soil will be transferred to a radiological screening yard (RSY) at Site 32. Other than temporarily placing soil immediately adjacent to an excavation, either while waiting to be loaded into a truck or allowing saturated soil to drain and dry, areas outside the RSY generally will not be used for soil laydown. The RSY pads may also function as soil drying pads. To avoid tracking material outside the excavation area, loose, muddy soil will be air dried to a damp state (based on visual observation) at the excavation site prior to transport to the RSY. Dump trucks transporting soil to the RSY will be lined and tarped and, wherever possible, transport the soil to the RSY via Perimeter Road.

6.3 RADIOLOGICAL CHARACTERIZATION

Radiological characterization will be performed once confirmation sampling confirms COCs are below the RGs. A gamma scan will be performed over 100 percent of the open excavation and additional soil samples will be collected to ensure a sampling frequency, including confirmation samples, of at least one sample every 50 m^2 of excavation surface, which approximates the sampling density of a MARSSIM Class 1 survey, or about 20 samples every 1,000 square meters. These samples will be systematically distributed across the excavation surfaces and analyzed for Ra-226 only.

Where there is standing water, material from the desired sample location will be removed from the excavation using the excavator bucket or equivalent. A grab sample will be collected from the material once it has been allowed to drain.

Excavations, including those backfilled at-risk, will be extended laterally or vertically until sample results confirm the Ra-226 concentrations are below the RG. Excavations may also be extended based on consultation with the Navy if there is visual confirmation of debris or if the soil is found to contain elevated radioactivity (in the form of elevated gamma activity). For sidewall exceedances, an additional 0.3-m lateral step-out will be excavated the length of the wall up to 1.5 m on either side of the sample location. For floor exceedances, an additional 0.3-m vertical step-down out will be excavated across a 3 m by 3 m floor area centered on the sample exceedance. The excavation step-out and step-down process will repeat until samples indicate Ra-226 concentrations are below the RGs.

6.4 RADIOLOGICAL SCREENING YARD

Soil excavated during excavation activities will be transported to an RSY at Site 32 to be radiologically screened for disposal. Since it is chemically contaminated, no attempt will be made to qualify the soil for re-use as backfill. Radiological controls, posting, maintenance, dust mitigation, air monitoring, and other measures appropriate for the RSY operation will be instituted. Following screening, the soil will be staged in Navy-designated areas pending off-site disposal by the Navy’s LLRW contractor.

6.4.1 Laydown Pad Construction

Laydown pads approximately 2,000 m^2 in size will be constructed by placing 10-mil thick plastic sheeting on the ground surface and wrapping the sheeting over hay bales placed at the perimeter to form a containment area to prevent run-off /on during precipitation events. A base layer of clean soil or bedding material 20 cm thick will be placed on the sheeting. A gamma scan of the constructed pad will be performed prior to use. Soil stockpile areas will be constructed by placing hay bales or wattles around the perimeter of each designated area. A layer of 10-mil thick plastic sheeting will be placed on the ground surface, then wrapped and secured over the hay bales or wattles. A sacrificial layer of soil will be laid down to protect the sheeting during stockpiling activities.

6.4.2 Radiological Screening

The soil will be spread out onto laydown pads in lifts approximately 20 cm thick. Debris such as large clay balls, rocks, asphalt, metal objects, plastic, or glass will be segregated from the soil and screened separately for proper disposal. A gamma scan will be performed over 100% of the spread-out soil and the data analyzed to identify radiation anomalies and to aid in the selection of biased sample locations. Areas where radiation levels appear higher are noted and flagged for field investigation. Twenty random-start systematic and up to five biased samples will be collected from each laydown pad of spread-out soil and analyzed for Ra-226. The biased samples will be collected from locations suspected to have the highest concentrations of radioactivity. Radioactive material, such as contaminated soil and ROs, identified during the investigation will be collected, segregated, and turned over to the Navy's LLRW disposal contractor. A minimum of one composite sample per laydown pad will be collected and analyzed for COCs in accordance with waste disposal facility requirements.

6.4.3 Stockpiling of Soil

Screened material may be stockpiled in the RSY if needed while awaiting Navy authorization for disposal. A sign or other physical marker will be used to identify each stockpile with maps showing the current location of all the stockpiles. Stockpiled soil will remain separate and segregated (i.e., each stockpile will consist of soil from a single screening on a given laydown pad) from other screened soil to retain data integrity and ensure there is no cross-contamination. Environmental protection measures (e.g., runoff/erosion control) will be implemented and maintained while the soil is stockpiled. Once approved by the Navy, the soil will be loaded and transported to the waste disposal facility.

6.5 DATA PACKAGES

Data packages will be compiled to document the results of the radiological survey and sampling performed of each excavation. Each data package will include survey and sampling data, numerical and graphical analyses of the data, field investigation results, recovered ROs (or other radioactive material, if any), and photos of ROs, debris encountered, and other salient site or material features. Where radioactive contamination is found, the package will include data demonstrating that the soil meets the soil release criteria based on RESRAD modeling using 12 mrem/yr, or, alternatively, include data sufficient to support a radiological characterization survey.

7.0 WASTE MANAGEMENT

Waste will be handled, stored, and disposed of in a manner protective of human health and the environment and in accordance with applicable regulatory requirements. Radioactively contaminated M&E, soil, and debris will be disposed as LLRW. Other waste, such as construction debris, will be disposed as non-radioactive waste. To eliminate the possibility of creating mixed waste, buildings will be radiologically surveyed and cleared prior to hazardous waste abatement. Likewise, to minimize the creation of additional hazardous waste, hazardous waste abatement will be performed prior to building demolition. The resulting demolition waste can then be disposed as construction debris in a Class III landfill. Similarly, excavated soil is chemically sampled for waste characterization, but also radiologically screened to eliminate the potential concern regarding the waste being mixed (i.e., chemically and radioactively contaminated), which requires special handling.

7.1 TYPES OF WASTE

The following radioactive/mixed wastes have the potential to be produced:

- Radioactively contaminated M&E, soil, and debris
- Radioactively and chemically contaminated M&E, soil, and debris
- Runoff from laydown pads, decontamination areas, and other wastewater
- ROs
- Discarded personal protective equipment (e.g., Tyvek™ coveralls, latex gloves), refuse, vegetative and other material based on generator knowledge and/or radiological/chemical sampling
- Waste generated during survey and sampling activities (e.g., paper towels, filters, tape, plastic sheeting, and plastic packaging)
- Concrete, asphalt, piping, and other non-soil and/or construction debris radiologically surveyed and released as not radioactively contaminated

7.2 HANDLING AND STORAGE

Waste will be stored temporarily at Navy-designated locations for sampling and analysis, to accumulate sufficient quantities for economical transportation and disposal, or to coordinate transportation between the carrier and the disposal site. Access to handling and storage areas will be controlled. Waste accumulation areas will be enclosed and/or roped-off, and appropriately posted. Wastes will be handled and stored within an RCA unless radiological survey and/or sampling data allow the material to be stored otherwise.

7.2.1 Solid Waste

Where possible, waste materials will be loaded into roll-off boxes, drums, or other appropriate containers at the point of generation. Radioactive/mixed wastes will be placed in bins provided by the Navy's LLRW contractor. An up-to-date inventory will be maintained of storage bins. A waste information fact sheet will be prepared for each RO that is recovered to detail the analytical information about the source to include photographs of the source, radionuclide identification, estimated curie content, and radiological survey information.

Wastes that are not loaded directly into transport containers will be stored in covered containers or in covered stockpiles that are maintained separately based on the type of waste (e.g., construction debris, chemically contaminated soil, etc.). Containers will be covered before being moved from the point of generation. Once containerized, waste will be stored at a suitable location designated by the Navy and will remain under Gilbane's control until transferred.

7.2.2 Liquid Waste

As a general rule, remediation activities will be designed to avoid the use of significant quantities of liquids requiring treatment and/or disposal. Minimal use of water is anticipated for dust control activities; however, the generation of free water will be avoided. Accumulated water will be managed in a manner similar to storm water run-off. Collected water is filtered or otherwise treated and sampled to verify compliance with the discharge permit prior to discharge. Filters and sediment from water treatment will be handled as solid waste.

7.3 WASTE MINIMIZATION

Waste will be managed by type based on waste stream characteristics and disposal facility requirements. Measures will be taken to avoid comingling of waste types from demolition or excavation, through handling and transport for disposal. For example, building inspections will identify waste streams based on hazardous waste type and the waste will be managed accordingly. Similarly, excavations will be are sequenced and managed by COC groupings (e.g., metals, PCBs, etc.) to facilitate RSY screening and subsequent waste characterization and handling.

7.4 TRANSPORTATION AND DISPOSAL

Transportation of soil and waste off-island will be performed by a licensed contractor. Haul trucks, whether loaded or empty, will pass through a four-step radiological screening process prior to leaving an RCA or other controlled area. First, loose dirt and debris will be cleaned off the dovetail and bed rail of the truck. The truck will then drive over a rumble strip to knock off any clumps of soil that may have attached to the truck. The truck tires and dovetail will be inspected for loose material, radiologically surveyed, and power-washed, if needed. The truck will then pass through a radiation portal monitor for final confirmation of successful radiological screening. All trucks will be tarped as well.

8.0 REFERENCES

ANL (Argonne National Laboratory), 2001. *User's Manual for RESRAD Version 6.0*. ANL/EAD-4. July.

ANL, 2003. *User's Manual for RESRAD Version 6.0*. ANL/EAD/03-1. June.

ANL, 2007. *Radiological and Chemical Fact Sheets to Support Health Risk Analyses for Contaminated Areas*. March.

ANL, 2009. RESRAD-BUILD for Windows, Version 3.5. October.

ANL, 2016. RESRAD-ONSITE for Windows, Version 7.2. July.

Bay Area Air Quality Management District, 1998, Regulation 11, Rule 2, *Asbestos Demolition, Renovation and Manufacturing*, October 7.

U.S. Army Corps of Engineers, 2014, *Safety and Health Requirements Manual*, EM 385-1-1.

DoD et al (U.S. Department of Defense , U. S. Department of Energy, U. S. Nuclear Regulatory Commission [NRC], and U. S. Environmental Protection Agency [EPA]), 2000. *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM). August (NUREG-1575).

EPA, 2006. *Guidance on Systematic Planning using the Data Quality Objectives Process* (QA/G-4). EPA/240/B-06/001. Final. February.

EPA, 2014. OSWER Directive 9200.4-40, R*adiation Risk Assessment at CERCLA Sites: Q&A*. June (EPA 540-R-012-13).

Gilbane (Gilbane Federal), 2017. *Installation Restoration Site 12 Remedial Action / Non-Time Critical Removal Action Work Plan, Former Naval Station Treasure Island, San Francisco, California* TBD.

IAEA (International Atomic Energy Agency), 1991. *Airborne Gamma-Ray Spectrometer Surveying*, Technical Report 323.

ISO (International Organization for Standardization). 1988. *Evaluation of Surface Contamination – Part 1: Beta Emitters (Maximum Beta Energy Greater Than 0.15 MeV) and Alpha Emitters*. ISO 7503-1, 1st edition.

NRC, 1981. *Radiation Safety Surveys at Medical Institutions*. Regulatory Guide 8.23. January.

TriEco-Tt, 2014. *Final Historical Radiological Assessment – Supplemental Technical Memorandum, Naval Station Treasure Island, San Francisco, California*. July.

ATTACHMENTS

ATTACHMENT 1

ALPHA/BETA MEASUREMENT DETECTABILITY

ATTACHMENT 1

ALPHA/BETA MEASUREMENT DETECTABILITY

Measurements of radioactivity at environmental levels involve very small amounts of radioactivity. Measurement uncertainty often makes it difficult to distinguish such small amounts from zero. Therefore, measurement detectability, expressed as the smallest concentration of radioactivity that can be reliably distinguished from zero, becomes an important measurement characteristic.

The method most often used to make a detection decision about radioactivity involves the principles of statistical hypothesis testing. To "detect" the radioactivity requires a decision on the basis of the measurement data that the radioactivity is present. The detection decision involves a choice between the null hypothesis (H_0): There is no radioactivity present (above background), and the alternative hypothesis (H_a): There is radioactivity present (above background). In this context, a Type I error, α, is to conclude that radioactivity is present when it actually is not, and a Type II error, β, is to conclude that radioactivity is not present when it actually is. Both types of decision errors were set to 0.05 (5%).

<u>When Background Counts Are High (> 100)</u>

When the background counts are high (> 100), traditional equations used to calculate the MDC, such as **Equation 1-1** used when the background count time (T_B) and sample count time (T_S) are not equal, work well. At lower background levels such equations can produce a high rate of Type I errors. This means that too often a decision is made that there is radioactivity present when it actually is not.

Equation 1-1

$$MDC = \frac{3 + 3.29\sqrt{R_B T_S \left(1 + \frac{T_S}{T_B}\right)}}{\varepsilon_i \varepsilon_s \frac{W_A}{100\ cm^2} T_S}$$

where:

R_B = background count rate (counts per minute [cpm])
T_B = background counting time (min)

T_S = sample counting time (min)
ε_i = instrument efficiency (counts per particle)
ε_s = surface efficiency (particles per disintegration [dis])
W_A = active area of the detector window (cm^2)

When Background Counts Are Low (< 100)

When the background counts are low (< 100), the *Multi-Agency Radiological Laboratory Analytical Protocols Manual* (MARLAP; DoD et al, 2004) reports that the Stapleton approximation appears to out-perform all of the other approximations reviewed (see MARLAP page number 20-47)[1]. Equation 3 from Table 7.6 of the *Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual* (MARSAME; DoD et al, 2009) uses the Stapleton approximation assuming the Poisson model and $T_B \neq T_S$[2]. The minimum detectable number of counts, SD, is defined as the number of counts that give a specified probability, $1 - \beta$, of being too large to be compatible with the premise that there is no radioactivity present (**Equation 1-2**).

Equation 1-2

$$S_D = \frac{\left(Z_{1-\alpha} + Z_{1-\beta}\right)^2}{4}\left(1 + \frac{T_S}{T_B}\right) + \left(Z_{1-\alpha} + Z_{1-\beta}\right)\sqrt{N_B \frac{T_S}{T_B}(1 + \frac{T_S}{T_B})}$$

where:

S_D = minimum detectable number of counts (cnts)
α = type I decision error or false positive; (0.05)
β = type II decision error or false negative; (0.05)
$Z_{1-\alpha}$ = $(1 - \alpha)$-quantile of the standard normal distribution, or $Z_{0.95}$ (1.645)
$Z_{1-\beta}$ = $(1 - \beta)$-quantile of the standard normal distribution, or $Z_{0.95}$ (1.645)
T_S = sample count time (min)
T_B = background count time (min)

[1] MARSSIM and MARLAP are complementary documents providing guidance on radiological surveys and measurements. MARSSIM addresses field measurements and sample collection, while MARLAP addresses laboratory measurements and sample processing. Guidance on assessing measurements in these manuals may be applicable to both field and laboratory applications.

[2] MARSAME is a supplement to MARSSIM, providing guidance on surveys of materials and equipment in addition to the surveys of real property (buildings and land areas) discussed in MARSSIM. As a supplement to MARSSIM, the guidance in MARSAME may be applicable to real property as well as materials and equipment.

N_B = background counts (cnts)

The MDC, in units of dpm/100 cm^2, may be calculated by converting the minimum detectable number of counts, S_D, to a concentration over a 100 cm^2 area using **Equation 1-3**.

Equation 1-3

$$MDC = \frac{S_D}{\varepsilon \frac{W_A}{100\ cm^2} T_S}$$

where:

S_D = minimum detectable number of counts
ε = total efficiency (cnts/dis)
W_A = active area of detector window (cm^2)
T_S = sample count time (min)

ATTACHMENT 2

TECHNICAL BASIS FOR USE OF CONTIGUOUS STATIC MEASUREMENTS IN LIEU OF SCANNING

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ATTACHMENT 2

TECHNICAL BASIS FOR USE OF CONTIGUOUS STATIC MEASUREMENTS IN LIEU OF SCANNING

The following presents the technical basis for Gilbane's use of contiguous static measurements in lieu of scanning in MARSSIM applications where measurements of alpha total surface radioactivity are called for. Contiguous static measurements are neighboring measurements of surface radioactivity that share proximity in both space and time, i.e., they are collected spatially near one another and at about the same time, with each measurement performed at a discrete location for a fixed count time.

Background:

The process described in MARSSIM (DoD et al, 2000) relies on scanning to provide a qualitative level of confidence that no areas of elevated residual radioactivity (i.e., radioactivity above the action threshold) remain that may have been missed by static measurements collected from across a survey unit. The probability of detecting elevated residual radioactivity by scanning is affected not only by the sensitivity of the instrument, but also by the surveyor's technique (i.e., holding the detector a specific distance from the surface while moving it at a constant speed) and the surveyor's ability to interpret the counts registered by the instrument. The surveyor must decide whether the counts represent background or radioactivity in excess of background that should be investigated.

The detection of elevated residual radioactivity by scanning is particularly problematic for alpha radioactivity where the number of counts necessary to exceed the action threshold approaches background levels where the expected instrument response is close to zero. Due to its random nature, radioactive decay is most easily measured by increasing the length of time over which the measurement is made. Consequently, the slower the scan speed, the higher the probability of detection. Beyond the cost consideration, however, the slower scan speed creates data quality issues as human reliability and randomness of radioactive decay become dominant variables. The two questions become:

1. Can a surveyor scanning at a very slow scan speed for an extended period of time reliably and consistently detect areas of elevated residual radioactivity that may exist?
2. Will the random and spontaneous radioactive decay event occur during the time interval that the detector is over the location of the elevated residual radioactivity and thus alert the surveyor to the location?

Design Advantages

Gilbane designed its contiguous static measurement methodology to remove the uncertainty inherent in the scanning process - in particular the human factor considerations - and to provide the necessary assurance that surfaces are free of radioactive contamination. These and other advantages achieved by the design include:

- Data quality concerns that often surround scanning (i.e., reliance on a human surveyor with its associated uncertainties - scan speed, increased count response, probability of detection) are eliminated.
- While the effective scan coverage is the same, significantly lower detection levels can be achieved, providing assurance that any areas of radioactive contamination are identified.
- The opportunity to miss an area of elevated residual radioactivity during scanning is removed through the process of collecting contiguous static measurements over the entire scan coverage area.
- Since they are discrete measurements performed at finite locations, contiguous static measurements may be used to demonstrate compliance with the release criteria.
- While scanning normally does not result in captured data, contiguous static measurements are captured and available for both numerical and graphical analyses.

Instrumentation

Contiguous static measurements are performed using an array of six Ludlum Model 43-37-1 821 cm^2 gas-flow proportional detectors coupled to a Ludlum Model 4612 12-channel counter. These commercially available "off-the-shelf" instruments were selected for use based on their reliable operation, detection sensitivity, operating characteristics, and performance in the field. They are industry-tested with proven reliability.

The Ludlum Model 43-37-1 detectors are mounted side-by-side lengthwise in a 3 x 2 configuration on a frame measuring approximately 58 cm by 136 cm. The dimensions of each detector are 15.9 cm wide by 64.1 cm in length. The frame orients the detectors relative to each other and the surface being measured. Each detector is independently spring-mounted within the frame so as to "float" free from the other five detectors. This allows each detector to conform to slight irregularity in the planar surface beneath it. A series of spacers around the edge of the face of each detector maintain the detector window less than 1 cm from the surface. When the detector array is moved into position, the detectors are held in contact with the surface by pressure from their compressed mounting springs.

The detector array is connected to a Ludlum Model 4612 12-channel counter, which supplies an alpha and beta channel for each of the six detectors. The counter is connected to a laptop computer by which the operating parameters of each detector are controlled. Each detector has independent high voltage, threshold, and window settings. The Model 4612 counter is configured with a single host board and a slave board for each detector. The slave board powers the detector and sends the count data to the host board. The host board collects the counts from each slave board and communicates with the computer. The computer collects and displays the data and is used to start and stop each count. The Model 4612 counter software (vendor supplied) monitors the activity of the counter and allows the surveyor to control and log data from the individual detectors. The software also allows the surveyor to modify the parameters of each slave board.

Detection Sensitivity

Exhibit 2-1 illustrates typical performance characteristics of a Model 43-37-1 detector used to perform a 1-minute count. Acceptable levels of total surface radioactivity are usually in the range of 1,000 dpm/100 cm^2 or higher for beta radioactivity, and 100 dpm/100 cm^2 – and in some cases lower – for alpha radioactivity. MDC values significantly below those levels are readily achievable for both alpha and beta radioactivity.

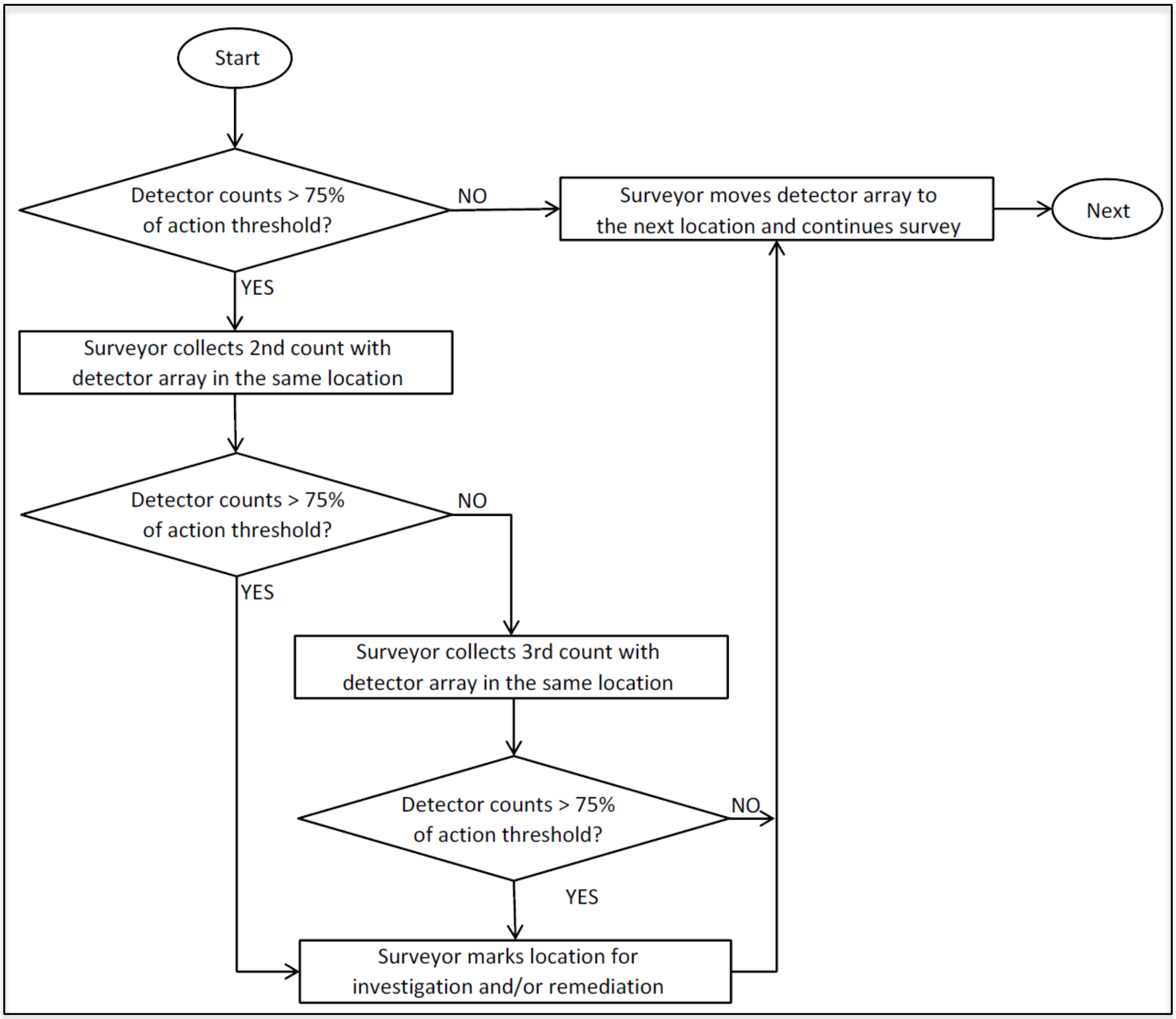
Exhibit 2-1. Ludlum Model 43-37-1 Detector Typical Performance Characteristics

Parameter	Alpha	Beta
Instrument background	7 cpm	1,400 cpm
Total efficiency (4π)	0.05 (5%)	0.13 (13%)
Count time	1 minute	1 minute
MDC	29 dpm/100 cm^2	121 dpm/100 cm^2

Measurement Methodology

The detector array is positioned against the floor or wall surface where the surface radioactivity measurements are to be obtained. As shown in **Exhibit 2-1**, a 1-minute count time is sufficient to produce an MDC less than one-half of most acceptable total surface contamination limits. The count is taken and logged in the computer. Twelve individual counts – two per detector (one alpha and one beta-gamma) - are captured along with a date/time stamp for each count. If any detector reports counts exceeding 75% of the action threshold, it is flagged and 2-out-of-3 logic is applied as shown in **Exhibit 2-2**.

Exhibit 2-2. Diagram Showing 2-Out-of-3 Logic



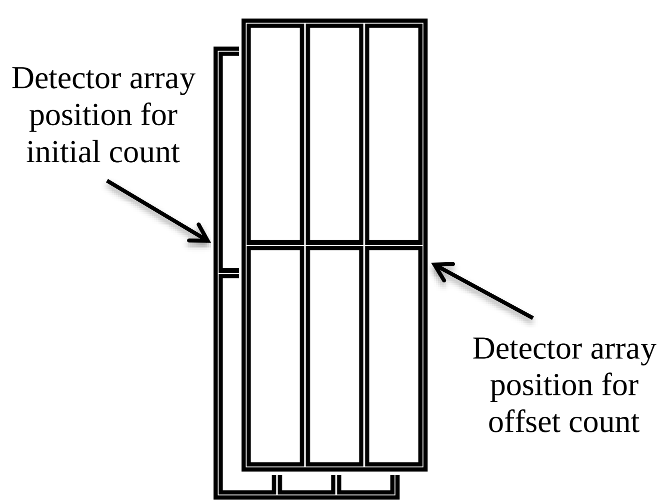
Locations where the detector counts exceed 75% of the action threshold 2 of out 3 times are marked for further assessment and/or remediation. The detector array is moved to the next measurement location and the process repeated until contiguous static measurements have been collected across the entire scan coverage area.

Effective Scan Coverage

The detector array covers a surface area of approximately 1.0 m^2. However, approximately 40% of the surface area covered by the detector array is outside a detector window (i.e., active area). In other words, only 60% of the surface area covered by the detector array is within the active area of a detector. So, taking measurements at a sequential spacing of one detector array-width would result in an effective scan coverage of 60%. That would be insufficient for a Class 1 survey unit which typically has a scan coverage requirement of 100%. To achieve equivalent 100% scan coverage, the detector array is moved to an offset position so that surface areas originally missed are now covered, as shown in **Exhibit 2-3**, and a second count is performed. The process is then continued by moving the detector array over one array-width and repeating the two-step count process.

The scan coverage of Class 2 and Class 3 survey units is typically much less than that of a Class 1 survey unit. Since a scan coverage of 60% is provided by the detector array itself, a higher scan coverage is achieved by overlapping the detector array positions, as illustrated in **Exhibit 2-3**. A lower scan coverage is achieved by increasing the spacing between detector array positions for each subsequent measurement.

Exhibit 2-3
Detector Array Offset to Achieve an Effective Scan Coverage of 100%



Small Area Coverage

A single Model 43-37-1 detector is used to perform contiguous static measurements in small or tight areas where the detector array cannot be used effectively (e.g., ledges, corners, irregularly shaped surfaces). The same measurement methodology is used, including the detector offsite method where the scan coverage requirement is greater than 60%.

Hot Spot Detection

A common requirement for scanning is that it not only be capable of detecting distributed contamination over a 1-m^2 area or larger, but also be capable of detecting a hot spot (i.e., small area of localized contamination) over an area as small as 100 cm^2. A routine practice in MARSSIM applications is to limit the hot spot activity to three times the action threshold for distributed activity. For example, where the action threshold for alpha total surface radioactivity is 100 dpm/100 cm^2, the scanning process must be able to detect a hot spot of 300 dpm over an area no larger than 100 cm^2.

A large-area detector such as the Model 43-37-1 cannot distinguish whether the counts are from radioactivity distributed over the entire active area of the detector or are localized over a smaller area. To determine whether the detector is capable of detecting a hot spot, the counts are assumed to be from a single 100 cm^2 area rather than distributed across the entire active area of the detector. The hot spot activity divided by the detector active area and multiplied by 100 gives the equivalent activity that the detector must be able to detect. For example, a Model 43-37-1 detector must be able to the detect alpha activity equivalent to 37 dpm/100 cm^2 to assure that a 100 cm^2 hot spot of 300 dpm alpha will be detected. The alpha MDC value from **Exhibit 2-1** shows that this level of hot spot detection is achievable with a 1-minute count time.

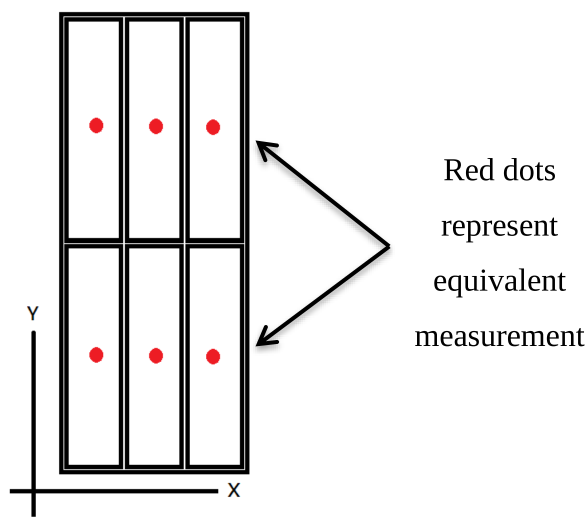
Demonstration of Compliance with Release Criteria

The MARSSIM process relies on a statistically significant number of static measurements collected from both random and systematically-spaced locations to demonstrate compliance with the release criteria. This results in 10, 20, or even 30 static measurement locations per survey unit. The advantage of contiguous static measurements is that they not only can be used in lieu of scanning, but also may be used as static measurements to demonstrate compliance with the release criteria since they are discrete measurements performed at finite locations.

The detector array yields measurement results for a total of six equivalent static measurement locations – one per detector – over each approximate 1.0 m^2 surface area. Assuming 100% scan coverage of a 100 m^2 Class 1 survey unit, for example, measurement results from a total of 1,200 equivalent static measurement locations would be generated (see detector offset method illustrated in **Exhibit 2-3**). This number of static measurements is 40 to 100 times more than the number of static measurements called for by MARSSIM. Of course, the number would be much lower for a Class 2 or Class 3 survey unit; however, it still would be several times more than the number of traditional static measurements collected per survey unit.

Numerical and Graphical Data Analysis

Exhibit 2-4
Measurement Coordinates Relate to Detector Position



Contiguous static measurements also are available for numerical and statistical analyses to identify trends, groupings, and outliers in the data population. Contiguous static measurement data may be graphed to identify patterns, relationships, or potential anomalies in the data that might go unnoticed using purely numerical methods. Since the detector counts are performed at discrete locations, each measurement can be assigned XY coordinates for purposes of mapping coverage or using graphical analytical techniques such as posting plots or contour maps. Where this is done, the measurements are assigned XY coordinates corresponding to the center of the detector, as illustrated in **Exhibit 2-4**, relative to a selected starting point (0,0) on the surface.

Summary

Contiguous static measurements provide not only equivalent and effective scan coverage when performed in lieu of scanning, but also form a robust data set both in quantity and quality which decision makers can use to make sound decisions regarding the absence of radioactive contamination.

References

Ludlum Measurements, Inc., 2014. *Ludlum Model 4612 12-Channel Counter*. December.

Ludlum Measurements, Inc., 2016. *Model 43-37 and Model 43-37-1 Gas Proportional Detectors*. December.

ATTACHMENT 3

DOSE AND RISK MODELING USING THE BUILDING OCCUPANCY SCENARIO

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ATTACHMENT 3

DOSE AND RISK MODELING USING THE BUILDING OCCUPANCY SCENARIO

The computer modeling software RESRAD-BUILD for Windows, Version 3.5 will be used to calculate a hypothetical dose and risk to members of the general public based on a building occupancy scenario.

Radiological Exposure Model

RESRAD-BUILD is a pathway analysis model developed to evaluate the potential radiological dose incurred by an individual in a building contaminated with radioactive material. The radioactive material within the building can be released to the indoor air by mechanisms such as diffusion (radon gas), mechanical removal (decontamination activities), or erosion (removable surface contamination). The air quality model in RESRAD-BUILD considers transport of radioactive dust particulates due to air exchange, deposition and re-suspension, and radioactive decay and ingrowth.

Exposure Scenario

The building occupancy scenario accounts for exposure to both fixed and removable thin-layer surface radioactivity. The scenario assumes that individuals occupy the building in a passive manner without deliberately disturbing the residual radioactivity on building surfaces. However, it also assumes the uncontrolled release of contaminants into the air as a result of normal use (e.g., cleaning the building, washing the walls, vacuuming the floors, etc.). Occupancy of the building is assumed to begin immediately after the building has been radiologically cleared for unrestricted use. The exposure duration is assumed to be a calendar year (365 days).

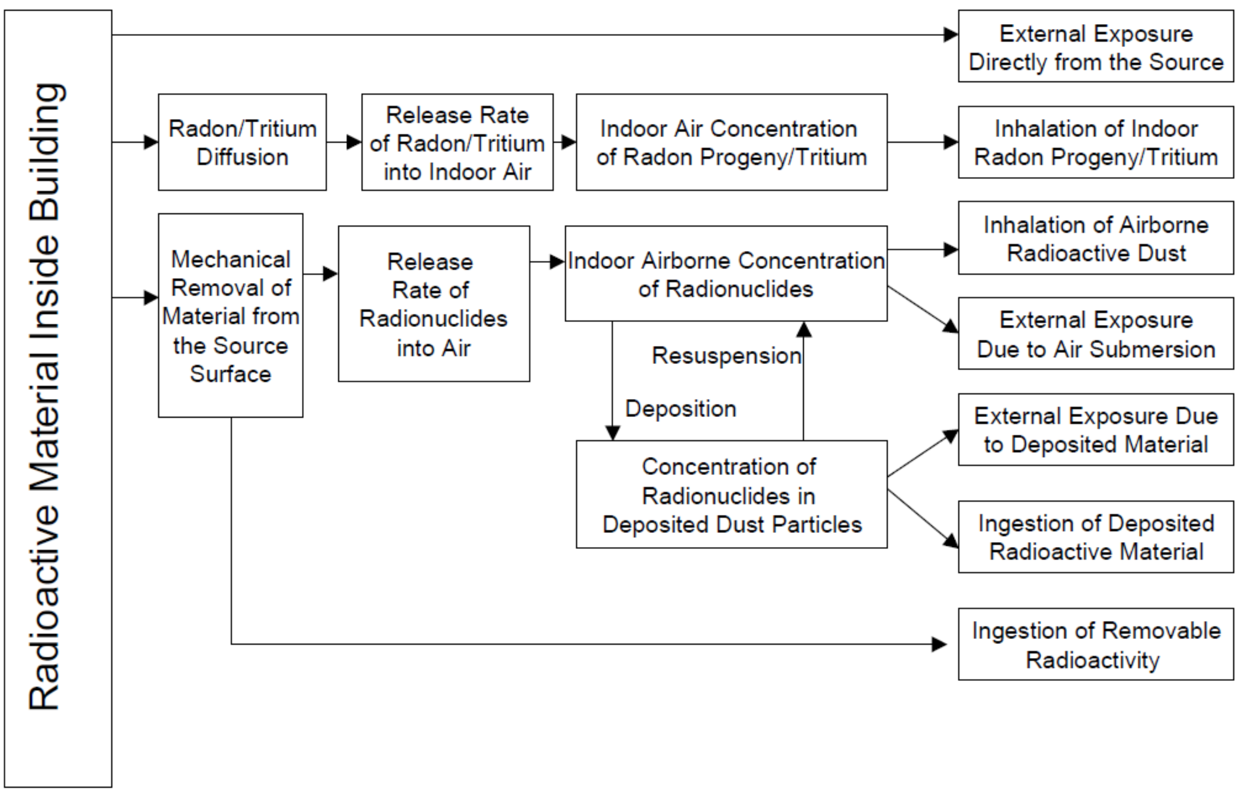
Critical Group

For the building occupancy scenario, the critical group is the building occupants who work in the building. The exposed occupants are the dose receptors, who can be office workers, residents, industrial workers, building visitors, or any individual spending time inside the contaminated building.

Exposure Pathways

The RESRAD-BUILD code models seven exposure pathways: (1) external exposure directly from the source, (2) external exposure to materials deposited on the floor, (3) external exposure due to air submersion, (4) inhalation of airborne radioactive particulates, (5) inhalation of aerosol indoor radon progeny, (6) inadvertent ingestion of radioactive material directly from the source, and (7) ingestion of materials deposited on the surfaces of the room. These exposure pathways are illustrated on **Exhibit 3-1**.

Exhibit 3-1. Exposure Pathways



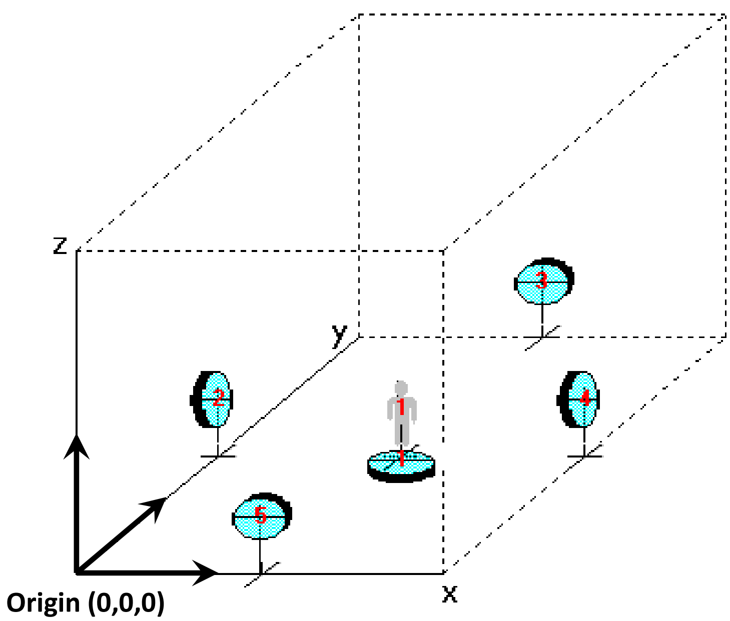
(Source: Figure 3.1, *User's Manual for RESRAD-BUILD Version 3.0* [ANL, 2003])

The first three pathways result in external exposure and the last four result in internal exposure. In RESRAD-BUILD, the external radiation doses are evaluated as effective dose equivalent, and the internal exposure is evaluated as committed effective dose equivalent. The conversion to effective dose equivalent weights the internal and external exposures such that their biological effect on the body can be summed. The total radiation dose, which is the sum of the external and internal doses, is then expressed as the total effective dose equivalent. The dose conversion factors used for inhalation, ingestion, and external exposures are discussed in detail in Appendixes D, E, and F, respectively, of the *User's Manual for RESRAD-BUILD Version 3.0* (ANL, 2003).

Building Description

The building used in the dose model is conceptualized as a single-room structure 6 m wide by 6 m long by 2.5 m high. A coordinate system used in RESRAD-BUILD defines the location of the radioactive sources and the dose receptor (building occupant) inside the room. **Exhibit 3-2** shows the point of origin located at the bottom left corner, with the x-axis measuring the horizontal distance to the right of the origin and coinciding with the bottom edge of the room; the y-axis being perpendicular into the room; and the z-axis measuring the vertical distance and coinciding with the left edge of the room.

Exhibit 3-2. Dose Receptor Position Relative to Radioactive Sources



The dose receptor is assumed to be a person standing on the floor in the center of the room. The receptor location is at the midpoint of the person, i.e., 1 m above the floor. A coordinate system used in RESRAD-BUILD defines the location of the radioactive sources and the dose receptor (building occupant) inside the room. **Exhibit 3-2** illustrates the dose receptor location in the center of the single-room structure. The location of the dose receptor is a critical factor for calculation of the external dose. The air quality model in RESRAD-BUILD assumes that the air is homogeneously mixed in the room. Therefore, the other pathways are not affected by the location of the dose receptor.

The room is assumed to be uniformly contaminated on the floor and lower walls (wall surfaces less than 2 m above the floor). No contamination is assumed on the upper walls or ceiling. The floor and the four lower wall surfaces are each modeled as a distinct finite plane source, for a total of 5 sources. Each radioactive source is defined by its location, based on the coordinates of its center, according to the system of coordinates used for the room, its area and the direction of the source. The contaminated area is defined as the surface area of the source facing the open air. Source direction is defined as the vector perpendicular to the exposed area, which is coincident with one of the axes (x, y, or z).

Radioactive Source Description

The radioactive source is assumed to be composed of Ra-226. The concentrations are based on actual measurements of alpha total surface radioactivity (fixed plus removable) collected from throughout the building. Ra-226 is assumed to be in equilibrium with its progeny.

Radioactive Source Transport

Mechanical removal and erosion of the source material, when the surface is exposed to open air, will result in the transport of part of its mass directly into the indoor air environment, resulting in airborne contaminants. Because of the air exchange process, the airborne particulates are loaded into the indoor air of the room and homogeneously mixed.

Modeling Parameters

Exhibit 3-3 lists the parameters used in the building occupancy scenario that are scenario-specific. Only those parameters different from RESRAD-BUILD defaults are listed. Other parameters remain at default values. It is assumed that for the building occupancy scenario, contamination is only on the surface. Detailed descriptions of parameters and their distributions are given in Appendix J of the *User's Manual for RESRAD-BUILD Version 3.0* (ANL, 2003).

Exhibit 3-3. Scenario-Specific Dose Modeling Parameters

Parameter	RESRAD-BUILD Default Value	Scenario-Specific Value
Receptor location (m)	1,1,1	3,3,1
Source type	volume	area
Source geometry	circular	rectangular
Number of sources	1	5
Dimension of source(s) (m^2)	36	36 (floor), 48 (walls)
Removable fraction (dimensionless)	0.5	0.2

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ATTACHMENT 4

DOSE AND RISK MODELING USING THE SUBURBAN RESIDENT SCENARIO

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ATTACHMENT 4

DOSE AND RISK MODELING USING THE SUBURBAN RESIDENT SCENARIO

The computer modeling software RESRAD-ONSITE for Windows, Version 7.2 (ANL, 2016) will be used to calculate a hypothetical dose and risk to members of the general public based on a suburban resident scenario.

Radiological Exposure Model

RESRAD-ONSITE is a pathway analysis model developed to evaluate the potential radiological dose incurred by an individual in an environment contaminated with radioactive material. The residential environment used in the dose model is conceptualized as a contaminated area of surface soil with a house on it. The model considers the transport of radioactive dust particulates due to re-suspension and radioactive decay and ingrowth.

Exposure Scenario

The suburban resident scenario accounts for exposure to radioactivity via a series of three exposure pathways: external exposure, inhalation of dust, and ingestion of soil. The scenario assumes that a person lives in the house and spends time both indoors and outdoors, but does not ingest any water, meat, milk, or food from onsite sources. Existing land use and activity restrictions at NAVSTA TI prohibit the consumption of food grown onsite.

Critical Group

For the suburban resident scenario, the critical group is the permanent residents who live in the house on the contaminated soil and spend time both indoors and outdoors. The exposed occupants are the dose receptors.

Exposure Pathways

The RESRAD-ONSITE code models three exposure pathways: (1) external exposure directly from the contaminated soil, (2) inhalation of dust, and (3) ingestion of soil. The first pathway results in external exposure and the last two result in internal exposure. In RESRAD-BUILD, the external radiation doses are evaluated as effective dose equivalent, and the internal exposure is evaluated as committed effective dose equivalent. The conversion to effective dose equivalent weights the internal and external exposures such that their biological effect on the body can be summed. The total radiation dose, which is the sum of the external and internal doses, is then expressed as the total effective dose equivalent. The dose conversion factors used for inhalation, ingestion, and external radiation exposures are discussed in detail in Appendixes A through J of the *User's Manual for RESRAD Version 6.0* (Argonne National Laboratory [ANL], 2001).

Radioactive Source Description

The radioactive source is assumed to be composed of Ra-226. The concentration is based on actual measurements of radioactivity in the soil.

Radioactive Source Transport

Soil particles that become airborne by re-suspension are transported to a human exposure location where they are inhaled. External exposure and ingestion do not rely on source transport in the environment.

Modeling Parameters

Scenario parameters and default parameter values used for the RESRAD-ONSITE code are presented in Appendices A through J of the *User's Manual for RESRAD Version 6.0* (ANL, 2001). The parameter values are kept at the RESRAD-ONSITE defaults for the suburban resident scenario with the single exception of the contaminated area. The actual survey unit surface area value will be used.

APPENDIX F

ENVIRONMENTAL PROTECTION PLAN

Naval Facilities Engineering Command Southwest
BRAC PMO West
San Diego, CA

FINAL
REMEDIAL ACTION/NON-TIME CRITICAL REMOVAL ACTION ENVIRONMENTAL PROTECTION PLAN

Installation Restoration Site 12

Report, Figure and Attachments 1, 2 and 3

Former Naval Station Treasure Island, San Francisco, CA

September 2018

Approved for public release; distribution is unlimited

DCN: GLBN-0005-4239-0011

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Naval Facilities Engineering Command Southwest
BRAC PMO West
San Diego, CA

FINAL
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Installation Restoration Site 12

Report, Figure and Attachments 1, 2 and 3

Former Naval Station Treasure Island, San Francisco, CA

September 2018

Prepared for:

Department of the Navy
Naval Facilities Engineering Command Southwest
1220 Pacific Highway
San Diego, CA 92132

Prepared by:

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Contract Number: N62473-17-D-0005; Task Order: N6247317F4239

DCN: GLBN-0005-4239-0011

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ATTACHMENTS

ACRONYMS AND ABBREVIATIONS

APP	Accident Prevention Plan
BAAQMD	Bay Area Air Quality Management District
BMPs	best management practices
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COCs	contaminants of concern
CSO	Caretaker Site Office
DCP	Dust Control Plan
D&D	decontamination and decommissioning
EPP	Environmental Protection Plan
Gilbane	Gilbane Federal
IR	Installation Restoration
NAVFAC	Naval Facilities Engineering Command Southwest
Navy	United States Department of the Navy
NPDES	National Pollutant Discharge Elimination System
NSTI	former Naval Station Treasure Island
NSWDA	non-Solid Waste Disposal Area
NTCRA	non-Time Critical Removal Action
Ra-226	Radium 226
RAOs	remedial action objectives
RG	remediation goal
ROC	radionuclide of concern
ROICC	Resident Officer in Charge of Construction
RPM	Remedial Project Manager
RWQCB	California Regional Water Quality Control Board
SSHP	Site Safety and Health Plan
SWDA	Solid Waste Disposal Area
SWP	Storm Water Plan
T&D	transport and disposal
TI	Treasure Island
USA	Underground Services Alert
USEPA	United States Environmental Protection Agency
Water Board	California Regional Water Quality Control Board, San Francisco Bay Region
WWII	World War II

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

This Environmental Protection Plan (EPP) was prepared by and will be implemented by Gilbane Federal (Gilbane). Gilbane has been contracted by the U.S. Department of the Navy, Naval Facilities Engineering Command (NAVFAC), Southwest Division, under Contract No. N62473-15-D-0811, Delivery Order PTO X001 to perform remedial action for soil contamination of the areas outside the solid waste disposal areas (SWDAs) within Installation Restoration (IR) Site 12 Old Bunker Area and the continuation of the IR Site 12 Non-Time Critical Removal Action (NTCRA) at the Northpoint SWDA at the former Naval Station Treasure Island (NSTI), San Francisco, California. This EPP is Appendix F to the Remedial Action / Non-Time Critical Removal Action Work Plan and supports the abatement, control, and mitigation measures to be implemented. For the purpose of this project, environmental protection is defined as maintaining the environment in its current state and enhancing or restoring the appearance of disturbed sites after construction activities are completed. This EPP addresses protection of air, water, and land resources and a Storm Water Plan, Dust Control Plan, and an Air Monitoring Plan are included as attachments to this EPP.

1.2 EXISTING NATURAL RESOUCES

Project activities will be conducted within IR Site 12, NSTI, San Francisco, California, which is largely a developed residential area with minimal vegetation. With no natural shorelines along IR Site 12, its interface with San Francisco Bay (SF Bay) is via constructed seawalls along the entire perimeter of Treasure Island.

The climate of the Central Bay Area is temperate and is influenced by the regional topography and proximity to the Pacific Ocean. The climate is fairly constant and predictable, having a bimodal seasonal pattern with respect to temperature and rainfall. Summers are typically warm and dry, with the exception of morning and evening fog due to a marine inversion layer. Winters are wet and cool with most annual precipitation occurring between October and March.

No wetlands registered on the U.S. Fish and Wildlife Services Wetlands Inventory exist within NSTI. The remedial activities are not located within a 100-year floodplain defined by the U.S. Geologic Survey.

No federally listed species are known to permanently reside on or in the vicinity of NSTI. However, San Francisco Bay is a seasonal home for birds migrating along the Pacific Flyway and numerous species of migratory birds have been observed at NSTI. Disturbance of habitats will be restricted to only those areas necessary for site mobilization and setup and locations where work is being performed.

1.3 SITE DESCRIPTION AND BACKGROUND

Naval operations began on Treasure Island in 1941. During World War II (WWII), the Navy used NSTI for training, administration, housing, and other support services to the U.S. Pacific Fleet. In 1993 NSTI was designated for closure under the Base Realignment and Closure Act of 1990, and was closed on September 30, 1997.

IR Site 12 is located on the northwest portion of NSTI (Figure 1) on a relatively flat 93-acre area. The site consists of multiplex housing units with private backyards and common area front yards, side yards, and surrounding greenbelts. Treasure Island is a man-made island adjacent to the naturally-occurring Yerba Buena Island, and was built for the Golden Gate International Exposition. The area was originally used as a parking lot during the Exposition. The Navy occupied the island in 1940, and the area was subsequently developed for bunker storage of munitions and other materials, vehicle and equipment storage, recreational playing fields, and disposal and burning of waste. Beginning in the 1960s, areas of IR Site 12 were incrementally developed into housing for Navy personnel and their dependents. To remediate chemicals in soil associated with chemical/fuel storage and disposal or burning of waste in SWDAs on the western portion of IR Site 12, a NTCRA was implemented in May 2006. During the initial stages of the NTCRA, a radiation survey and sample analytical results identified debris and soil contaminated with radium-226 (Ra-226).

1.3.1 Topography and Site Features

IR Site 12 is generally flat and consists of residential buildings and landscapes, asphalt, concrete, and soil overgrown with weeds. Surface soils at NSTI consist of imported dredged materials, primarily sands with some small gravels, silt, and clay. Soils encountered during previous drilling and trenching activities consisted of primarily fine- to coarse-grained loose sands and gravel. The estimated depth-to-groundwater at IR Site 12 ranges from approximately 3.5 to 5 feet. Along the western and northern boundary of IR Site 12 at the edge of Treasure Island and in the Gateview Total Petroleum Hydrocarbon (TPH) area, the water table is subject to tidal influence. In the center of the island near the Halyburton Court, the water table is not subject to tidal influence.

1.3.2 Installation Restoration Site 12 History

During the Golden Gate International Exposition in 1939 and 1940, the majority of the area that now encompasses IR Site 12 was used for vehicle parking. After the Navy took over the lease of NSTI and throughout the 1940s, 1950s, and 1960s, ammunition bunkers were located in the northern half of IR Site 12. From the early 1940s until about 1968, 21 ammunition bunkers were located in the IR Site 12 area. Disposal units and general SWDAs were in the vicinity of some of the bunkers. The southern part of IR Site 12 also included part of a former runway, general storage, fueling station, and miscellaneous buildings. From approximately 1966 to 1988, four military housing series (1100, 1200, 1300, and 1400 series) were constructed at IR Site 12. The 1100, 1200, 1300 and 1400 series buildings were completed in 1966, 1969, 1974, and 1988, respectively (Navy, 2017).

IR Site 12 was included in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process in 1988 because of findings in the Final Preliminary Assessment/Site Inspection report (Dames and Moore, 1988). These findings documented the potential for soil and groundwater contamination from debris that may not have been entirely removed during housing construction. The concentrations and distribution of contaminants of concern (COCs) and solid waste within the residential housing areas are uncertain because of the variable distribution of solid waste and COCs resulting from grading operations. In 2002, the IR Site 12 boundary was expanded to include all existing residential areas (Navy, 2017).

2.0 REMEDIAL ACTION

The main objective of this project is to achieve the remedial action objectives (RAOs) and remedial goals (RGs) for soil within IR Site 12 at the former NSTI. Areas are designated as potentially radiologically impacted when historical and process knowledge cannot substantiate that no radiological contamination is present. As a consequence, potentially radiologically impacted areas require investigation, potential decontamination and decommissioning (D&D), and/or remediation, confirmation surveys, and closure. These activities are planned, in-process, or nearly complete for the subject sites.

2.1 PLAN IMPLEMENTATION

2.1.1 Project Organization

The Gilbane Project Manager and site superintendent, as supported by the Quality Control Manager, will be responsible for implementing and monitoring compliance with this EPP.

2.1.2 Training

The contents of this EPP will be conveyed to Gilbane personnel and contracted employees working at project field sites. Training will include instruction on detection and prevention of pollution on-site, as well as, procedures for responding to potential spills or contaminant releases. Employees will also be instructed on the installation and maintenance of dust and erosion control measures.

3.0 ENVIRONMENTAL PROTECTION

To accomplish environmental protection during radiological surveying and material removal activities at the former NSTI, protection will be provided to air, water, and land resources, including management of visual aesthetics; possible natural, historical, and archeological resources; noise; and solid waste.

The Gilbane Project Manager will implement the EPP and ensure that work is performed in accordance with the approved Site Safety and Health Plan (SSHP; Gilbane, 2017). Measures will be implemented to control dust by adequately covering the extent of the excavation sites and monitoring upwind and downwind areas during the remedial action field activities, as discussed in Section 3.1. All precautions will be taken to ensure dust creation is minimized and dust monitoring levels are not exceeded. Zero visible dust shall be present during the remedial action. Petroleum odors can be a nuisance to the nearby public; therefore, mitigation techniques to control petroleum odors will be implemented. Monitoring will be conducted to ensure that petroleum vapors are below health and safety criteria for the workers and nearby community.

3.1 PROTECTION OF AIR RESOURCES

Project activities will be conducted in a manner that minimizes the release of airborne particulates within or outside the project boundaries. The principal concern for site excavation activities associated with material removal involves controlling dust potentially containing radionuclides of concern (ROCs). Air monitoring for dust will be performed in accordance with the Air Monitoring Plan (which is included as Attachment 3 to this EPP), the SSHP (Gilbane 2017) and the Radiological Management and Demolition Plan, (which is Appendix E to the Remedial Action / NTCRA Work Plan). To accomplish this, air monitoring will be employed to encompass the entirety of remediation excavations, including downwind areas. All possible engineering controls and best management practices (BMP) are in accordance with the Storm Water Plan and Dust Control Plan (DCP) and will be employed to ensure that dust is not created in quantities greater than acceptable to regulation. Equipment operations and activities or processes performed during and related to remediation (Ex. stockpiled material) will be conducted according to Bay Area Air Quality District regulations and federal emissions and performance laws and standards.

3.2 DUST CONTROL

The DCP is Attachment 2 to this EPP and describes the dust control measures to be implemented as part of field work activities. The DCP supports the abatement, control, and mitigation measures to be used during the remedial action for soil Dust control will be employed around all excavations, embankments, stockpiles, waste areas, and all other work areas to avoid hazardous or nuisance conditions. At the end of each workday, active work areas will be swept or washed as appropriate to minimize the potential for fugitive dust during non-working hours.

3.3 BURNING AND HOT WORK

Burning and Hot Work refer to activities involving open flame or posing a potential fire hazard (Example: welding). No hot work is anticipated at this time; however, if hot work is required, a permit to conduct this activity will be coordinated through the Navy Caretaker Site Office (CSO) / Resident Officer In Charge of Construction (ROICC) offices.

3.4 NOISE

As stated in the Site Safety and Health Plan (Gilbane, 2017) APP, engineering controls and BMPs will be employed to control excess noise generation. Construction activities will be monitored for excessive noise pollution and will comply with the provisions of the California Noise Control Regulation.

Noise control will comply with applicable Occupational Safety and Health Administration and local noise standards. Equipment operators, contractors, and other personnel will be required to wear appropriate hearing protection when necessary, as detailed in the APP Appendix A of the SSHP (Gilbane, 2017).

3.5 PROTECTION OF SURFACE AND GROUNDWATER RESOURCES

Precautions will be taken to provide for the environmental integrity of surface water and groundwater resources at and around project work sites. Essential water protection practices that will be employed include:

- Transfer of respective wastes to the designated Navy basewide radiological and hazardous waste transportation and disposal (T&D) contractors;
- Excavated and D&D-generated materials will be controlled to prevent these materials from polluting surface water or groundwater resources, and
- Water used in on-site processes (decontamination and dust suppression) will not be allowed to re-enter a surface water resource if it will adversely affect the water resources.

Remediation construction activities will be conducted in compliance with applicable federal, state, and local laws regarding potential and actual contamination of surface water and groundwater, and in a manner that will prevent the discharge of pollutants and minimize impacts to water resources. To comply with the substantive requirements of the State of California General Construction National Pollutant Discharge Elimination System (NPDES) Permit, a

Storm Water Plan (SWP) will be prepared that describes the BMPs for erosion control that will be used during this project. The SWP will be transmitted to Base Realignment and Closure (BRAC) and the regulatory oversight agencies prior to commencement of field work. In developing the SWPPP, the Erosion and Sediment Control Field Manual (California Regional Water Quality Control Board [RWQCB], 2002) will be used as guidance.

To reduce potential impacts to the quality of surface water and groundwater, construction personnel will not service vehicles or construction equipment outside designated staging areas, and all equipment will be inspected daily for fuel and/or hydraulic oil leaks. If they occur, hydraulic system leaks will be repaired immediately.

3.6 PROTECTION OF LAND AND ARCHEOLOGICAL RESOURCES

Activities at excavation sites will be conducted in a manner that minimizes impacts to land resources within and outside the project boundaries. Before and after photographs will document conditions for each excavation area. Unless such work is indicated on the drawings or specified in the scope of work, Gilbane will not remove, cut, deface, injure, or destroy trees, shrubs, grasses, topsoil, wetlands, or other land forms without prior approval from the Navy. Any vegetation scarred or damaged from work on this project will be restored as nearly as possible to its original or better conditions, as determined by Navy Biologists. Site features such as roads and fences, if disturbed to facilitate excavations will be restored.

Currently, there are no historical, archaeological, or cultural resources identified within the work area. If potentially important resources are found during the course of this project, Gilbane will take every precaution to preserve them. Potential resources covered by this section that may trigger a site review or additional protections include human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rocks, pavings, walls, or other constructed features; and indications of agriculture or other human activities. If such resources are discovered, the Site Superintendent will immediately report the findings to the ROICC and Remedial Project Manager (RPM). Work in the area will be stopped, and Gilbane will record, report, and preserve the finds in accordance with federal regulations covering the Protection of Archaeological Resources (43 Code of Federal Regulations Subtitle A Part 7) and the National Historical Preservation Act.

3.7 LANDSCAPE PROTECTION

Gilbane will coordinate with the ROICC prior to excavation activities at each site to identify any land resources to be preserved within the work area. Gilbane personnel will mark any areas to be preserved and provide fencing, barriers, or other physical protection. Gilbane will minimize damage to land resources within and outside project work areas, and will repair any damage caused to land resources.

3.8 PROTECTION OF BENCHMARKS, MONUMENTS AND GROUNDWATER MONITORING WELLS

Gilbane will locate benchmarks, monuments, and groundwater monitoring wells within the authorized work and staging areas. As part of site preparation prior to clearing and grubbing, benchmarks, monuments, and well locations will be demarcated with flags or another visible feature. Care will be taken during all field activities to protect existing wells.

3.9 PROTECTION OF UNDERGROUND UTILITIES

Prior to beginning intrusive subsurface activities, underground utilities will be identified and, to the extent possible, located. Gilbane comprehends that utilities may be installed with plastic or clay pipe and may not be locatable using conventional geophysical methods. As a consequence and to employ utility locating BMPs, utilities will be located by Underground Service Alert (USA). USA will be notified of pending excavations 48 hours or more in advance of breaking ground. In addition, Gilbane will use Navy utility drawings to locate and demarcate underground utilities. Field observations of surface expressions (e.g., cleanouts, risers, manholes) will be used as guides during the utility marking work. Identified underground utilities will be demarcated using color-coded surveyor paint applied according to American Public Works Association-approved colors. To facilitate utility locating, proposed excavation areas will be marked on the ground using white paint. The marked area will be larger than proposed excavation dimensions to provide coverage in the event that actual excavations are larger than proposed excavations. Meetings or conference calls may be scheduled with all interested utility providers and consumers that may be affected by the excavation activities.

4.0 POST CONSTRUCTION RESTORATION AND CLEANUP

Cleanup, demobilization, and restoration will be performed after completion of fieldwork. This restoration will be performed by Gilbane after the fieldwork phase is completed and will be accepted by the CSO and ROICC. Final site restoration and cleanup may include the following:

- Collecting and disposing of contractor-generated contaminated material, debris, disposable personal protective equipment, and rubbish
- Removing support area facilities
- Removing temporary fences and signs installed under this contract
- Mechanical broom sweeping of work areas and haul routes
- Hydroseeding disturbed areas as a stormwater run-on run-off prevention measure

With the completion of site restoration and cleanup, field activities will be considered complete. Personnel will conduct pre-final and final inspections with the CSO and ROICC to identify, document and address deficiencies. Gilbane will notify the CSO and ROICC when corrections are completed.

5.0 UPDATING THE ENVIRONMENTAL PROTECTION PLAN

This EPP will be updated as needed to reflect changing site conditions. A copy of the approved CERCLA Storm Water Plan shall be kept on-site and be continually updated as regulations require reflecting current site conditions.

6.0 REFERENCES

Gilbane, 2017. *Site Safety and Health Plan and (Accident Prevention Plan, Appendix A), Installation Restoration Site 12 Remedial Action*. October.

Navy, 2017. *Final Record of Decision/Final Remedial Action Plan for Installation Restoration Site 12 (Non-Solid Waste Disposal Areas and Non-Radiological) Former Naval Station Treasure Island San Francisco, California*. March.

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FIGURES

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NAVFAC Naval Facilities Engineering Command	**IR Site 12 Non-SWDA Remedial Action/ SWDA Removal Action** Former Naval Station Treasure Island San Francisco, CA	**Figure 1** Treasure Island Location Map

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ATTACHMENTS

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FINAL

CERCLA STORMWATER PLAN

REMEDIAL ACTION AT INSTALLATION RESTORATION SITE 12

Former Naval Station Treasure Island

San Francisco, California

Contract Number N62473-17-D-0005
Task Order Number CTO-N6247317F4239
Document Control Number: GLBN-0005-4239-0011

Prepared for:

Department of the Navy

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SWP Prepared by:

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SWP Preparation Date

September 2018

Estimated Project Dates:

Start of Construction	Completion of Construction
August 13, 2018	**February 25, 2019**

Table of Contents

List of Tables

List of Figures

List of Appendices

Acronyms and Abbreviations

ºC	degrees Celsius
ºF	degrees Fahrenheit
§	Section
4,4-DDD	4,4-dichlorodiphenyldichloroethane
alpha-BHC	alpha-benzene hexachloride

BAT/BCT	Best Available Technology/Best Control Technology
bcy	bank cubic yard
bgs	below ground surface
BMPs	Best Management Practices
BRAC	Base Realignment and Closure
CASQA	California Stormwater Quality Association
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	chain of custody; contaminant of concern
CSMP	Construction Site Monitoring Program
CSO	Caretaker Site Office
CTO	contract task order
EPA	U.S. Environmental Protection Agency
FSS	Final Status Survey
Gilbane	Gilbane Federal
HCl	hydrochloric acid
HDPE	high density polyethylene
HNO3	nitric acid
IR	Installation Restoration
L	liter
LLMW	low-level mixed waste
LLRW	low-level radiological waste
MDL	method detection limit
mL	milliliter
NA	not applicable
NAL	numeric action level
Navy	United States Department of the Navy
NAVFAC SW	Naval Facilities Engineering Command Southwest
NAVSEA	Naval Sea Systems Command
NEL	Numeric Effluent Limitations
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NSTI	Naval Station Treasure Island
NTU	nephelometric turbidity unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PM	Project Manager
PMO	Program Management Office
QA/QC	quality assurance and quality control
QSD	Qualified SWPPP Developer
QSP	Qualified SWPPP Practitioner
RADMAC	Radiological Multiple Award Contract
RASO	NAVSEA Detachment Radiological Affairs Support Office
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
REAP	Rain Event Action Plan

RL	risk level
RMDP	Radiological Management and Demolition Plan
ROICC	Resident Officer in Charge of Construction
RSY	radiological screening yard
RUSLE	Revised Universal Soil Loss Equation
RWQCB	Regional Water Quality Control Board
SAP	sampling and analysis plan
SFO	San Francisco International Airport
Site	IR Site 12, at former Naval Station Treasure Island, San Francisco, California
SSHP	Site-Specific Safety and Health Plan
SOW	scope of work
SVOC	semivolatile organic compound
SWP	Stormwater Plan
SWRCB	State Water Resources Control Board
TI	Treasure Island
TMDL	Total Maximum Daily Load
TPH	total petroleum hydrocarbons
TPH-g	TPH, gasoline range
TPH-d	TPH, diesel range
TPH-mo	TPH, motor oil range
ug/L	micrograms per liter
VOA	volatile organic analysis
VOC	volatile organic compound
WDID	Waste Discharge Identification Number
WMP	Waste Management Plan
YBI	Yerba Buena Island

Qualified SWPPP Developer (QSD)

Approval and Certification of the CERCLA Stormwater Plan

Project Name:	*Remedial Action at Installation Restoration Site 12 at former Naval Station Treasure Island* *San Francisco, California*
Project Number/ID	*Contract #: N62473-17-D-0005* *Task Order #: CTO-F4239* *Gilbane Federal Project #: J310000300*

"This CERCLA Stormwater Plan and Appendices were prepared under my direction to meet the applicable requirements of the California Construction General Permit (State Water Resources Control Board [SWRCB] Orders No. 2009-009-DWQ as amended by Order 2010-0014-DWQ). I certify that I am a Qualified Stormwater Pollution Prevention Plan (SWPPP) Developer (QSD) in good standing as of the date signed below."

QSD Signature	12 *September 2018* *Date*
Cenk Ergin, P.E. *QSD Name*	*00375* *QSD Certificate Number*
Senior Design Engineer, Gilbane Federal *Title and Affiliation*	*925-946-3260* *Telephone Number*
cergin@gilbaneco.com *Email*	

Amendment Log

Project Name: *Remedial Action at Installation Restoration Site 12 at former Naval Station Treasure Island*
San Francisco, California

Project Number/ID: *Contract #: N62473-17-D-0005*
Task Order #: CTO-F4239
Gilbane Federal Project #: J310000300

Amendment Number	**Date**	**Brief description of amendment (include section and page number)**	**Prepared and approved by**
			Name: QSD#
			Name: QSD#
			Name: QSD#
			Name: QSD#
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			Name: QSD#
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Section 1 CERCLA SWP Requirements

1.1 INTRODUCTION

This Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Storm Water Plan (SWP), presents the substantive measures that will be implemented to minimize sediment and other pollutants in stormwater runoff during the implementation of construction activities during the remedial action activities to be performed in the non-Solid Waste Disposal Areas (SWDA) within Installation Restoration (IR) Site 12 (Old Bunker Area) and to continue the IR Site 12 non-time critical removal action (NTCRA) at the Northpoint SWDA at the former Naval Station Treasure Island (NSTI) in San Francisco, California (Figure 1).

This CERCLA SWP has been prepared to specifically address the activities associated with the Radiological Multiple Award Contract (RADMAC II) under Contract Number N62473-17-D-0005, Contract Task Order (CTO) F4239, to the Naval Facilities Engineering Command Southwest (NAVFAC SW).

The project involves removal of up to 4,000 bank cubic yards (bcy) of soil excavated from 58 discrete locations, demolition of two buildings (1126 and 1217), excavation of soil beneath the buildings, including screening, transporting, and disposing of building materials and soil as appropriate. An additional 4,000 bank cubic yards of screened soil is already staged at Site 6 and Site 32 and will also be transported and disposed as appropriate.

The 58 discrete locations each measure 10 feet wide, 10 feet long, and 4 feet deep to 10 feet deep. The building demolition footprint of Building 1126 measures 80 feet wide, 170 feet long, and, while the footprint of Building 1217 measures 80 feet wide, 130 feet long The proposed excavations will be 4 feet deep beneath both buildings.

Total disturbed area due to the remediation activities included in current scope of work (SOW) is less than an acre and the activities will be conducted under Section 121(e) of CERCLA. Therefore, this construction project is not covered by the *National Pollutant Discharges Elimination System (NPDES) General Permit for Storm Water Discharges Associated with*

Construction and Land Disturbance Activities issued by the California State Water Resources Control Board (SWRCB, 2012 and most of the requirements of the General Permit do not apply to this project. However, for the purpose of establishing a SWP, Gilbane identified and addressed the applicable requirements of the General Permit, including Best Management Practices (BMPs) to be implemented for construction activities, BMPs to be implemented for erosion and sediment control, waste management and disposal spill responses, post-construction controls, site inspection and monitoring programs, responsible personnel, and training requirements.

This CERCLA SWP was designed to address the following objectives. To ensure that:

- All pollutants and their sources, including sources of sediment associated with construction, construction site erosion, and other sources or activities associated with construction are controlled.
- Where not otherwise required to be under a Regional Water Quality Control Board (RWQCB) permit, all non-stormwater discharges are identified and either eliminated, controlled, or treated.
- Site BMPs are effective and result in the reduction or elimination of pollutants in stormwater discharges and authorized non-stormwater discharges from construction activity to the Best Available Technology/Best Control Technology (BAT/BCT) standard.
- Stabilization BMPs, installed to reduce or eliminate pollutants after construction, are identified, implemented, and completed.

1.2 CERCLA SWP AVAILABILITY AND IMPLEMENTATION

This CERCLA SWP will be available at the Site (in Building 570 which will serve as the administrative field office at NSTI) during working hours while construction and/or field activities by the contractor are occurring, and will be made available upon request by a United States Department of the Navy (Navy), state, or municipal inspector. When the original CERCLA SWP is retained by a crew member in a construction vehicle and is not currently at the construction site, current copies of the BMPs, maps, and drawings will be left with the field crew and the original CERCLA SWP will be made available via a request by radio or telephone. The CERCLA SWP will be implemented concurrently with the start of ground-disturbing activities, under the supervision of the SWP Implementer.

1.3 CERCLA SWP AMENDMENTS

The CERCLA SWP will be amended or revised when:

- There is a reduction or increase in total disturbed acreage.
- BMPs do not meet the objectives of reducing or eliminating pollutants in stormwater discharges.
- There is a change in construction or operations that may affect the discharge of pollutants to surface waters, groundwater, or a separate municipal storm sewer system.
- There is a change in the project duration that changes the project's risk level.
- Deemed necessary by the CERCLA SWP developer or implementer.

The following items will be included in each amendment:

- The name, project title, and certification number of the individual who prepared the amendment.
- The name and project title of the individual who requested the amendment.
- The location(s) of the proposed change(s).
- The reason for the change(s).
- The original BMP(s), if any.
- The new BMP(s) proposed, as applicable.

Amendments will be logged at the front of the CERCLA SWP. The CERCLA SWP text will be revised, replaced, and/or hand-annotated as necessary to properly convey the amendment.

1.4 RETENTION OF RECORDS

Paper or electronic records of documents required by this CERCLA SWP will be retained for a minimum of three years from the date generated or for the time frame required by Navy Contract N62473-17-D-0005, Contract Task Order (CTO)-F4239, whichever is longer.

These records will be available at NSTI until construction is complete. Records assisting in the determination of compliance with the General Permit will be made available within a reasonable time, to the RWQCB, SWRCB, or U.S. Environmental Protection Agency (EPA) upon request. Requests by the RWQCB for retention of records for a period longer than 3 years will be accommodated.

1.5 NOTICE OF TERMINATION

As the Navy contractor, Gilbane Federal (Gilbane) will prepare a final site map and take photographs to verify that all CERCLA SWP requirements have been met. The final site map and photographs will be submitted as part of the final report following completion of the project, and within 90 days of meeting all requirements for termination and final stabilization, including the following:

- The Site will not pose any greater sediment discharge risk than the Site did prior to construction activities.
- All construction-related equipment, materials, and any temporary BMPs no longer needed are removed from the Site.
- Post-construction stormwater management measures (if required) are installed.

Section 2 Project Information

2.1 PROJECT AND SITE DESCRIPTION

2.1.1 Site Location

NSTI is in San Francisco Bay, midway between San Francisco and Oakland, California (see Figure 1). The facility consists of two contiguous islands: the northern island is named Treasure Island (TI) and the southern island is named Yerba Buena Island (YBI). TI is a man-made island and was constructed of sediments dredged from San Francisco Bay. TI was constructed in 1936 and 1937 for the initial purpose of hosting the Golden Gate International Exposition held in 1939-1940. The Navy acquired by condemnation in 1942. Military activities at YBI date back to 1866 when the US Government took possession of YBI for defensive fortifications. The Navy operated the first West Coast Naval Training Station on YBI until 1923, when the center was transferred to San Diego. The project Site is located on the northeast corner of NSTI, as shown on Figure 2. The latitude and longitude of NSTI are 37°49'21.00"N and – 122°21'53.85"W, respectively.

IR Site 12 is located on the north end of NSTI. IR Site 12 consists of the SWDAs on which military housing was built in 1968. IR Site 12 is predominantly a residential housing area, consisting of residential buildings with fenced back yards, open grassy areas between the buildings, common areas, and paved roads and parking areas. This scope of work requires excavating 58 discrete sampling locations and demolition of 2 buildings within the geographical footprint of IR Site 12. The project area includes excavation of 4,000 bcy with in the SWDAs inside the IR Site 12 boundary.

2.1.2 Existing Site Topography

TI is a 403-acre flat, man-made island that consists primarily of sand dredged from the Bay and retained by a perimeter of rock and sand dikes. TI ranges in elevation from 9 to 12 feet above mean sea level, based on the National Geodetic Datum (NGVD) of 1929. TI was constructed of sediments dredged from San Francisco Bay.

2.1.3 Existing Drainage & Stormwater

The topography of the entire island is relatively flat and the stormwater is managed through storm drains installed throughout the island which direct water runoff towards the Bay.

2.1.4 Climate

In general, the climate of the area is marine and characterized by very little change in temperature. The average annual precipitation is about 25 to 30 inches. Most precipitation falls between October and April. Localized showers are infrequent and storms are moderate in duration and intensity. The average annual air temperature is 56 to 58 degrees Fahrenheit, and the average frost-free period is 300 to 330 days. The relative humidity in winter is about 80 to 90 percent at night and 60 to 70 percent in the afternoon. Humidity is less in spring, but increases at night in summer. Humidity is lowest in fall. It ranges from 50 percent during the day to 70 percent at night. Morning and evening fog frequently occur during the summer. The wind direction for the area is predominately from the west-northwest throughout the year. The average wind speed ranges from 8 miles per hour to 14 miles per hour and annually averages 11 miles per hour. Winds from the north and east are sometimes accompanied by cold temperatures in winter and spring. Westerly winds in summer are generated by the cool marine air flowing to the warmer interior. These winds are strongest early in summer, mainly late in the afternoon and in the evening.

2.1.5 Geology and Groundwater

TI was constructed on the Yerba Buena Shoals, a sand spit that extends north and northwest of Yerba Buena Island. Subsurface materials at the TI can be divided into the following five units, listed from the youngest to the oldest: (1) Fill (dredged sand fill), (2) Shoal Sands (Yerba Buena Shoal Sands), (3) Younger Bay Mud, (4) Older Bay Mud, (5) Franciscan Assemblage.

TI and YBI are surrounded by the waters of the San Francisco Bay. Any surface drainage off the two islands flows into the Bay. Ground water at TI is generally present at depths of 2.5 to 6 feet below ground surface (bgs). Subsurface water at TI has no beneficial use and is not currently used.

2.1.6 Project Description

The ground-disturbing site activities included in the scope of work for this CTO include the following.

- Pre-excavation soil borings to delineate the extent of contamination from the non-SWDA locations;
- Radiological survey and removal of contaminated soil from 58 discrete locations and the Northpoint SWDA; and
- Demolition and radiological survey/removal of contaminated soil from the footprints of Buildings 1126 and 1217.

The pre-excavation soil borings will involve the use of a direct push rig (or equivalent) to collect vertical core borings at the discrete locations to be excavated. The analytical results will be used to delineate the vertical extent of the excavation and to use as confirmation samples, as outlined in the Remedial Action/Non-time Critical Removal Action Work Plan (RAWP; Gilbane, 2018a) to which this SWP is appended.

The radiological survey and removal of contaminated soil from 58 discrete locations and the Northpoint SWDA will involve excavating soil that contains contaminants of concern (COCs) and may contain Radium-226 at levels above the established criteria, as outlined in the RAWP (Gilbane, 2018a).

Depending on accessibility of construction equipment and digging conditions, excavations will be performed by a combination of mechanical equipment (excavators, mini-excavators, and backhoes) and hand digging. Soil generated during the excavation activities will be sampled and screened against the potential chemical contaminants and radiation per the Waste Management Plan (WMP) as appended to the RAWP (Gilbane, 2018a).

Following completion of excavation activities, radiological characterization will be completed in accordance the Radiological Management and Demolition Plan (RMDP; Appendix E of the RAWP) once confirmation sampling demonstrated that COCs are below the remedial goals.

Excavated soil will be stockpiled at the intersection of 13th Steet and Avenue M (IR Site 32), and will be utilized as a radiological screening yard (RSY) pad for scanning and radiologically characterizing the excavated soil (Figure 2). Once the RSY is no longer needed, the laydown pads and soil stockpile areas will be deconstructed and the site returned to its pre-use condition . Excavated material will be hauled off site for disposal after waste profile sampling, landfill waste acceptance, and waste profile approval as described in the WMP (Appendix B of the RAWP).

Prior to leaving exclusion zones (as established in the RMDP and WMP as appendices to the RAWP, the exterior of each truck will be decontaminated if necessary, and the load will be covered with a tarpaulin, as described in the RAWP (Gilbane, 2018a).

The project consists of the following work elements:

- Utility locating.
- Preparatory activities and meetings.
- Environmental resources surveying.
- Saw-cutting asphalt/concrete pavement for pothole excavation (if required).
- Mobilization.
- Stormwater, sediment, and erosion control.
- Pre-excavation soil borings
- Demolition
- Excavation and confirmation sampling
- Radiological surveys and sampling.
- Backfill placement and compaction.
- Site restoration (asphalt repairs) to match the existing surface.
- Free release survey and decontamination of equipment.
- Waste classification, storage, and disposal.
- Demobilization.

Detailed descriptions of the above activities are provided in the RAWP (Gilbane, 2018a), to which this CERCLA SWP is an attachment.

2.1.8 Developed Condition

Post-construction surface drainage will be unchanged from the pre-construction surface drainage because there will be no change in the percentage of permeable and impermeable covers or in the existing surface topography.

2.2 STORMWATER RUN-ON FROM OFFSITE AREAS

During trench excavations, run-on will be adequately managed or diverted upstream of the trench locations, such that the risk of erosion by upslope stormwater is eliminated.

2.3 CONSTRUCTION SCHEDULE

The construction activities resulting in disturbance of the soil are expected to take place between August 22, 2018, and December 4, 2018. The QSP or the QSP representative will contact the Qualified SWPPP Developer (QSD) if the schedule changes during land disturbance activities associated with the project to address potential impacts to the CERCLA SWP. The estimated schedule for planned work can be found in Appendix A.

2.4 POTENTIAL CONSTRUCTION ACTIVITY AND POLLUTANT SOURCES

The project site is impacted by the following non radiological constituents: lead, chrome, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), dioxins, and selected pesticides (4,4-dichlorodiphenyldichloroethane [4,4-DDD] and alpha-benzene hexachloride [alpha-BHC). It is also impacted by Radium-226 (Gilbane, 2018a). Sediment and soil in project site locations may contain some of these analytes. The total disturbed area is less than 1 acre and storm runoff risk from the potholes, scoop-holes, building footprints, and stockpiles will be eliminated by utilizing the proper BMPs listed in the SWP. Therefore, the receiving water risk level for the project is low.

Appendix B includes a list of construction activities and associated materials that are anticipated to be used onsite. These activities and associated materials will or could potentially contribute pollutants, other than sediment, to stormwater runoff.

The anticipated activities and associated pollutants were used in Section 3 to select the BMPs for the project. Locations of temporary BMPs are shown on Figure 3.

Collection of discharge samples for non-visible pollutant monitoring will be triggered when a breach, malfunction, leakage, or spill is observed. Collection of discharge samples for non-stormwater will be triggered when a release of non-storm water running off the project site is observed. Sampling requirements for non-visible pollutants associated with construction activity for this project are discussed in Section 7.7.1. A chemical inventory of products used by on-site personnel is retained onsite at the construction trailer.

2.5 IDENTIFICATION OF NON-STORMWATER DISCHARGES

Non-stormwater discharges consist of discharges that do not originate from precipitation events. When applicable, the General Permit provides allowances for specified non-stormwater discharges that do not cause erosion or carry other pollutants.

Non-stormwater discharges into storm drainage systems or waterways that are not authorized under the General Permit and listed in the CERCLA SWP, or are not authorized under a separate NPDES permit, are prohibited.

Non-stormwater discharges that are authorized by the Navy for this project site include the following:

- Water to control dust.
- Discharges from emergency fire-fighting activities.
- Waters used to wash vehicles and equipment, provided that there is no discharge of soaps, solvents, or detergents used for such purposes.

These authorized non-stormwater discharges will be minimized by implementing the stormwater and non-stormwater BMPs described in Section 3 of this CERCLA SWP.

The activities at this Site that may result in unauthorized non-stormwater discharges include:

- Diesel and gasoline fuel used for mechanical equipment.
- Fluids in vehicles and equipment, including fuels, coolants, non-fuel oil-based fluids, and lubricating and hydraulic oils.
- Use of portable toilets for field personnel.
- Decontamination of field equipment.

Steps - including the implementation of appropriate BMPs - will be taken to ensure that unauthorized discharges are eliminated, controlled, disposed, or treated onsite.

Discharges of construction materials and wastes, such as fuel or marking paint, resulting from dumping, spills, or direct contact with rainwater or stormwater runoff, are prohibited.

2.6 REQUIRED SITE MAP INFORMATION

The site layout map for the work actions to be performed is shown on Figure 2.

The map will be updated accordingly as changes occur in the field. Figures 1, 2, and 3 show the project location, surface water boundaries, geographic features, construction areas, site perimeter, drainage patterns, and selected best management practices (BMPs). Table 2.1 identifies the figure where required elements are illustrated.

Table 2.1 Required Map Information

Included on Figure Number[1]	Required Element
Figure 1	The project's surrounding area (project location and vicinity map)
Figure 2	Site layout
Figure 2, 3	Construction site boundaries
Figure 2, 3	Areas of soil disturbance (temporary or permanent)
Figure 3	Locations of runoff BMPs (as temporary BMPs)
Figure 3	Locations of erosion control BMPs (as temporary BMPs)
Figure 3	Locations of sediment control BMPs (as temporary BMPs)
Figure 2, 3	Vehicle storage areas
Figure 2, 3	Material storage areas (i.e., laydown area)
Figure 2, 3	Fueling Locations

[1] Indicates figure on which specific information is included (e.g., Vicinity Map, Site Map, Drainage Plans, etc.)

Section 3 Best Management Practices

3.1 SCHEDULE FOR BMP IMPLEMENTATION

In consideration of the objectives identified in Section 1.1, this CERCLA SWP includes actions and practices to address the following.

- Identify potential pollution sources associated with stormwater, including soil-disturbing activities that increase the potential for erosion and transport of soil, discharges of polluting materials related to activities, and discharges of stored materials or wastes.
- Ensure that the potential impact of rainfall and surface water run-on from offsite are properly assessed and managed.
- Identify, construct, and implement BMPs in accordance with the project activity time schedule and maintain the BMPs for prevention of the potential discharges identified above, using appropriate levels of technology, field practices, and monitoring.
- Develop a maintenance schedule for BMPs installed during field activities designed to reduce or eliminate pollutants after site characterization is completed (post-construction BMPs).
- Establish an inspection and monitoring plan and program to ensure that the BMP prevention and control measures remain effective throughout the period of field activities.
- Include a Stormwater Site Monitoring Program designed to acquire and evaluate information related to the relative effectiveness of this CERCLA SWP.

To achieve these actions and practices, BMPs as identified in Table 3.1 will be implemented prior to initiation of land disturbance activities, and as appropriate for each drilling location.

Table 3.1 BMP Implementation Schedule

	BMP Fact Sheet Number, Title	Implementation	Duration
Erosion Control (EC)	EC-1, Scheduling	Start of Construction	Entirety of Project
	EC-2, Preservation of Existing Vegetation	Start of construction	Entirety of project
	EC-6, Straw Mulch	Start of construction	Entirety of project
	EC-9 Earth Dikes	Start of Construction	Entirety of Project
Non-Stormwater (NS)	NS-1, Water Conservation Practices	Start of Construction	Entirety of Project
	NS-2 Dewatering Operation	Start of Construction	Entirety of Project
	NS-6 Illicit Connection- Illegal Discharge Connection	Start of Construction	Entirety of Project
	NS-8, Vehicle and Equipment Cleaning	Start of Construction	Entirety of Project

Table 3.1 BMP Implementation Schedule

	BMP Fact Sheet Number, Title	Implementation	Duration
	NS-9, Vehicle and Equipment Fueling	Start of Construction	Entirety of Project
	NS-10, Vehicle/Equipment Maintenance	Start of Construction	Entirety of Project
Sediment Control (SE)	SE-5, Fiber Rolls	Start of Construction	Entirety of Project
	SE-6, Gravel Bag Berm	Start of Construction	Entirety of Project
	SE-7, Street Sweeping	Start of Construction	Entirety of Project
	SE-8, Sand Bag Barrier	Start of Construction	Entirety of Project
	SE-10, Storm Drain Inlet Protection	Start of Construction	Entirety of Project
Wind Erosion (WE)	WE-1, Wind Erosion Control	Start of Construction	Entirety of Project
Temporary Materials (Waste) Management (WM)	WM-01 Material Delivery and Storage	Start of Construction	Entirety of Project
	WM-02 Material Use	Start of Construction	Entirety of Project
	WM-03 Stockpile Management	Start of Construction	Entirety of Project
	WM-04 Spill Preservation and Control	Start of Construction	Entirety of Project
	WM-05 Solid Waste Management	Start of Construction	Entirety of Project
	WM-06 Hazardous Waste Management	Start of Construction	Entirety of Project
	WM-07 Contaminated Soil Management	Start of Construction	Entirety of Project
	WM-09 Sanitary-Septic Waste Management	Start of Construction	Entirety of Project
	WM-10 Liquid Waste Management	Start of Construction	Entirety of Project

3.2 EROSION AND SEDIMENT CONTROL

Erosion and sediment controls are required to provide effective reduction or elimination of sediment-related pollutants in stormwater discharges and authorized non-stormwater discharges from the site. Applicable BMPs are identified in this section for erosion control, sediment control, tracking control, and wind erosion control.

The field work is designed to prevent the spread of soil contamination during excavation, accumulation, and transportation of waste soil. Soil will be directly loaded into trucks whenever possible to minimize stockpiles. Excavations will be restored as soon as possible after backfilling so that the fill material will not be eroded from the excavation by wind or rain. BMPs such as sand bags or gravel bags will be implemented if heavy rain is predicted at backfilled trench excavations, to slow the flow of any stormwater towards storm drain inlets.

3.2.1 Erosion Control

Erosion control, also referred to as soil stabilization, consists of source control measures designed to prevent soil particles from detaching and becoming transported in stormwater runoff. Erosion control BMPs protect the soil surface by covering and/or binding soil particles.

This project will implement the following practices to provide effective temporary and final erosion control during construction.

- Control the area where soil-disturbing operations take place such that the contractor is able to implement erosion control BMPs quickly and effectively.
- Stabilize non-active areas within 14 days of cessation of construction activities, or sooner if stipulated by local requirements.
- Control erosion in concentrated flow paths by applying sandbags, gravel bag berms, or equivalent methods.

Sufficient erosion control materials will be maintained onsite to allow implementation in conformance with this CERCLA SWP.

The following temporary erosion control BMP selection table (Table 3.2) indicates the BMPs (including EC and WE BMPs) that will be implemented to control erosion for the field activities. Fact Sheets for temporary erosion control BMPs are provided in Appendix C.

Table 3.2 Temporary Erosion Control BMPs

CASQA Fact Sheet	BMP Name	Meets a Minimum Requirement[1]	BMP Used		If not used, state reason
			YES	NO	
EC-1	Scheduling	✓	✓		
EC-2	Preservation of Existing Vegetation	✓	✓		
EC-3	Hydraulic Mulch	✓[2]		✓	Straw mulch used for short term needs
EC-4	Hydroseed	✓[2]		✓	Straw mulch used for short term needs
EC-5	Soil Binders	✓[2]		✓	Straw mulch used for short term needs
EC-6	Straw Mulch	✓[2]		✓	
EC-7	Geotextiles and Mats	✓[2]		✓	Straw mulch used for short term needs
EC-8	Wood Mulching	✓[2]		✓	Straw mulch used for short term needs
EC-9	Earth Dike and Drainage Swales	✓	✓		
EC-10	Velocity Dissipation Devices			✓	Not Applicable to Construction Area conditions.
EC-11	Slope Drains			✓	Not Applicable to area of field activities
EC-12	Stream Bank Stabilization			✓	Not Applicable to area of field activities
EC-13	Polyacrylamide	✓		✓	Not Applicable to area of field activities
EC-14	Compost Blankets	✓[2]		✓	Not needed as majority of existing vegetation will remain intact
EC-15	Soil Preparation-Roughening			✓	Same as above
EC-16	Non-Vegetated Stabilization	✓[2]		✓	Same as above.
WE-1	Wind Erosion Control	✓	✓		
Alternate BMPs Used:					**If used, state reason:**

[1] Applicability to a specific project will be determined by the QSD.

[2] The QSD will ensure implementation of one of the minimum measures listed or a combination thereof to achieve and maintain the risk level requirements.

CASQA = California Stormwater Quality Association

3.2.2 Implementation of Erosion Control BMPs

BMPs will be deployed in a sequence to follow the progress of field activities and resulting soil disturbance. As the locations of field activities change, erosion controls will be adjusted accordingly to control stormwater runoff at the downgradient site perimeter, as necessary. BMPs will be mobilized as follows:

Throughout Construction:

- The CERCLA SWP implementer will monitor weather using National Weather Service reports to track conditions and alert crews to the potential onset of rainfall events.
- Soil-disturbing activities will not be performed during significant rainfall events (50% probability of 0.5 inches of precipitation per day or more). When the planned field activities are interrupted by a significant rainfall event, soil disturbance will not resume until Site soil conditions are suitable.
- Disturbed soil areas will be stabilized with temporary erosion control or with permanent erosion control as soon as practicable after field activity at each construction (remediation) location is completed.

During the Non-Rainy Season

- The project schedule will sequence field activities with the installation of both erosion control and sediment control measures in advance of a significant rainfall event.

During the Rainy Season:

- Disturbed areas will be stabilized with temporary or permanent erosion control before significant rainfall events.
- Prior to forecasted significant rainfall events, temporary erosion control BMPs will be deployed and the integrity and effectiveness of these BMPs will be inspected.

These temporary erosion control BMPs will be implemented in conformance with the following guidelines and as outlined in the BMP Fact Sheets provided in Appendix C. If there is a conflict between documents, the RAWP will prevail over narrative in the body of the CERCLA SWP or guidance in the BMP Fact Sheets. The narrative in the body of the CERCLA SWP prevails over guidance in the BMP Fact Sheets.

Scheduling

The trenching, removal of existing sewer and storm drain pipes, and backfilling will be sequenced to minimize the amount and duration of soil exposed to erosion by wind, rain, runoff, and vehicle tracking.

Preservation of Existing Vegetation

Preservation of existing vegetation will protect soil erosion while decreasing the amount of BMPs required on site. Areas to be preserved from construction traffic will be marked. To the extent practical, temporary roadways, stockpile areas, and laydown areas will be located to avoid damaging existing vegetation.

Straw Mulch

Straw Mulch will be used around the drilled holes, excavations, and areas being back filled.

Earth Dike and Berms

Berms will be built upstream of the trench excavations by utilizing sand bags to divert and control stormwater runoff during trench excavation. Sand bag berms can divert sheet flow over slopes, prevent run-on into open trench excavations or active construction zones, and control erosion along with transport of sediment.

Wind Erosion Control

Dust control measures will be used to stabilize soil from wind erosion and to reduce dust generated by clearing and grading activities, construction vehicle traffic on unpaved areas, and sediment tracking onto paved roads. Water spray will be used to control dust and wind erosion, with water application controlled to prevent surface runoff. Water trucks will be used for dust control. In addition to wet suppression (watering), preventive measures to be used for dust control include minimizing disturbed surface areas, limiting on-site vehicular traffic and speed, and controlling the number and activity of vehicles on the Site at a given time

3.2.3 Sediment Controls

Sediment controls are temporary or permanent structural measures that are intended to complement the selected erosion control measures and reduce sediment discharges from active construction areas. Sediment controls are designed to intercept and settle out soil particles that have been detached and transported by the force of water.

The following sediment control BMP selection table (Table 3.3) indicates the BMPs that will be implemented (including SE and TC BMPs) to control sediment on the construction site. Fact Sheets for temporary sediment control BMPs are provided in Appendix C.

Table 3.3 Temporary Sediment Control BMPs

CASQA Fact Sheet	BMP Name	Meets a Minimum Requirement[1]	BMP used		If not used, state reason
			YES	NO	
SE-1	Silt Fence	✓[2] [3]		✓	Other methods used
SE-2	Sediment Basin			✓	Other methods used
SE-3	Sediment Trap			✓	Other methods used
SE-4	Check Dams			✓	No constructed drainage swales in area of field activities
SE-5	Fiber Rolls	✓[2][3]	✓		
SE-6	Gravel Bag Berm	✓[3]	✓		
SE-7	Street Sweeping	✓	✓		
SE-8	Sandbag Barrier		✓		
SE-9	Straw Bale Barrier			✓	Other methods used such as fiber rolls
SE-10	Storm Drain Inlet Protection	✓	✓		
SE-11	ATS			✓	Not applicable to the level of risk.
SE-12	Temporary Silt Dike			✓	Other methods used
SE-13	Compost Sock and Berm	✓[3]		✓	Other methods used
SE-14	Biofilter Bags	✓[3]		✓	Not required for this project
TC-1	Stabilized Construction Entrance and Exit	✓		✓	There is no separate entrance or exit to the site.
TC-2	Stabilized Construction Roadway			✓	Not required for this project
TC-3	Entrance Outlet Tire Wash	✓		✓	There is no separate entrance or exit to the site.
Alternate BMPs Used:					**If used, state reason:**

[1] Applicability to a specific project will be determined by the QSD.
[2] The QSD will ensure implementation of one of the minimum measures listed or a combination thereof to achieve and maintain the risk level requirements.
[3] Risk Level 2 and 3 determinations will require linear sediment control along toes of slopes, faces of slopes, and at the grade breaks of exposed slopes.

These temporary sediment control BMPs will be implemented in conformance with the following guidelines and in accordance with the BMP Fact Sheets provided in Appendix C. If there is a conflict between documents, the RAWP Work Plan will prevail over narrative in the body of the CERCLA SWP or guidance in the BMP Fact Sheets. The narrative in the body of the CERCLA SWP prevails over guidance in the BMP Fact Sheets.

During the Non-Rainy Season

- Temporary sediment controls will be implemented at the draining perimeter of disturbed soil areas before significant rainfall events.
- Fiber rolls and gravel bags will be maintained onsite and deployed as barriers when needed.

During the Rainy Season

- Temporary sediment controls will be implemented at the draining perimeter of disturbed soil areas.
- Fiber rolls will be deployed along the toes of slopes of the stockpiled soils to filter stormwater run-off.
    - Fiber rolls and sandbags will be used on the ground surface around the area of drilling, excavating, and backfilling and storm inlets during significant rainfall events (50 percent probability of 0.5 inches of precipitation per day or more).

Sandbags

Sandbags will be used upstream of the trench excavations as a drainage diversion and for sediment trapping and stormwater velocity and erosion control. The sandbags also will be installed around the stormwater inlets for protection purposes.

Sandbags may be used at the following locations at the site:

- Around and along the downgradient toes of all soil stockpiles.
- Below active construction areas.
- In concentrated drainage flow courses and in areas downgradient of active work areas, as needed.
- As a diversion berm to stormwater run-on upgradient of active work areas and trench excavations.

Fiber Rolls

Fiber rolls can be used to control sediment by reducing flow velocity and allowing sediment to settle. Filter barriers will be installed on the ground surface around the storm drain inlets. In areas where heavy traffic occurs, filter fabric will be placed inside the inlets.

Filter barriers may be used at the following locations at the Site:

- Around stockpiles and stockpile staging areas.
- Downgradient of any active areas where soil disturbance may be expected.
- At operational storm drains as a form of inlet protection.

Gravel Bag Berm

Gravel bag berms allow for water to temporarily pond while allowing sediment to settle. Protection of storm inlets will be achieved utilizing gravel bag berms, as well as sandbags.

Storm Inlet Protection

Storm drain inlets adjacent to construction activities will be protected from any authorized or unauthorized non-stormwater discharges. Gravel and/or sand bags and/or fiber rolls will be applied.

3.3 NON-STORMWATER CONTROLS AND WASTE AND MATERIALS MANAGEMENT

3.3.1 Non-Stormwater Controls

Non-stormwater discharges into storm drainage systems or waterways, which are not authorized under the General Permit, are prohibited. Non-stormwater discharges for which a separate NPDES permit is required by the RWQCB are prohibited unless coverage under a separate NPDES permit has been obtained for the discharge. The selection of non-stormwater BMPs is based on the list of construction activities with a potential for non-stormwater discharges identified in Section 2.5 of this CERCLA SWP.

Non-stormwater wastewater generated on the Site may include water from decontamination of equipment and personnel and from dewatering of excavations or saturated excavated soil. Wastewater may be stored on the Site as described in the RAWP to prevent releases to the surface and storm drains and will be disposed of as described in the RAWP. Wastewater will be sampled in accordance with the RAWP and may be disposed into the sanitary sewer if it meets publicly owned treatment system acceptance limits. Water not meeting those requirements will be transported off site to the appropriate disposal facility.

Table 3.4 identifies the non-stormwater control BMPs that will be implemented (including NS BMPs) to control non-sediment discharges to stormwater drains at the Site. Fact Sheets for temporary non-stormwater control BMPs are provided in Appendix C.

Table 3.4 Temporary Non-Stormwater BMPs

CASQA Fact Sheet	BMP Name	Meets a Minimum Requirement(1)	BMP used		If not used, state reason
			YES	NO	
NS-1	Water Conservation Practices	✓	✓		
NS-2	Dewatering Operation		✓		Not Applicable to field activities
NS-3	Paving and Grinding Operation			✓	Not Applicable to field activities
NS-4	Temporary Stream Crossing			✓	Not required for the field activities
NS-5	Clear Water Diversion			✓	Not required for the field activities
NS-6	Illicit Connection- Illegal Discharge Connection	✓	✓		
NS-7	Potable Water Irrigation Discharge Detection			✓	Not required for the field activities
NS-8	Vehicle and Equipment Cleaning	✓	✓		
NS-9	Vehicle and Equipment Fueling	✓	✓		
NS-10	Vehicle and Equipment Maintenance	✓	✓		
NS-11	Pile Driving Operation			✓	Not Applicable to field activities
NS-12	Concrete Curing			✓	
NS-13	Concrete Finishing			✓	
NS-14	Material and Equipment Use Over Water			✓	No field activities or materials/equipment use over water
NS-15	Demolition Removal Adjacent to Water			✓	No demolition activities adjacent to water in current SOW
NS-16	Temporary Batch Plants			✓	Not required for field activities
Alternate BMPs Used:					**If used, state reason:**

(1) Applicability to a specific project will be determined by the QSD.

Non-stormwater BMPs will be implemented in conformance with the following guidelines and in accordance with the BMP Fact Sheets provided in Appendix C. If there is a conflict between documents, the RAWP will prevail over narrative in the body of the CERCLA SWP or guidance in the BMP Fact Sheets. The narrative in the body of the CERCLA SWP prevails over guidance in the BMP Fact Sheets.

Water Conservation Practices

Appropriate water application and conservation practices will be followed to ensure that water used onsite does not create surface flow capable of carrying pollutants off the footprint area for field activities.

Dewatering Operation

Excavations and sampling locations may fill with water or surfaces may accumulate ponded water during rainstorms or from wave overtopping or wave splash. Groundwater also may infiltrate excavations due to high tides or storm surge. Saturated soils will be allowed to drain above the excavation before the excavator bucket is emptied. Soil removed from the excavation will be transported to the radiological screening pad and placed in 6-inch layers for dewatering. [Note: Wet soil cannot be measured accurately for radiological screening.] Wastewater resulting from stormwater runoff, dewatering of soil, and decontamination will be collected and contained in tanks or other appropriate containers. Although not expected, water generated from dewatering activities, if collected or containerized, will be subject to the storage and treatment requirements described in the WMP (Appendix B).

Illicit Connection- Illegal Discharge Connection

The Contractor will implement this BMP (identified as NS-6) throughout the duration of the project. Any identified illicit connection or discharge will be reported to the Navy and the RWQCB immediately.

Vehicle and Equipment Cleaning

Vehicle and equipment cleaning will occur in designated decontamination areas constructed with containment for decontamination water.

Vehicle and Equipment Fueling

Diesel Fuel

During construction, fuel will be stored at the Building 570 complex. Fueling will occur away from drainage courses to prevent run-on of stormwater and runoff of spills. If a spill occurs as equipment is fueled, the spill will be immediately contained with a spill kit. The individual noting the spill will be responsible for contacting the Project Superintendent, who will notify the Navy, which in turn is responsible for notifying the regulatory agencies as necessary, and for managing the cleanup and removal of contaminated soils in accordance with regulations.

<u>Fuels for Equipment and Vehicle-Related Lubricants</u>

Fueling of equipment at the project site will occur in designated areas at the the Building 570 complex, which is located away from drainage courses, to prevent the run-on of stormwater and the runoff of spills. If a spill occurs as equipment is fueled, the spill will be contained immediately with spill kits, and an excavation retention trap will be provided. The individual noting the spill will be responsible for contacting the Project Superintendent, who will notify the Navy, which in turn is responsible for notifying the regulatory agencies as necessary and for managing cleanup and removal of contaminated soils in accordance with regulations.

A limited variety of vehicles and equipment will be used throughout the project, including excavators, steel plate compactors, backhoes, and trucks. BMPs NS-9 and NS-10 will be used to prevent discharges of fuel and other vehicle fluids on or in the vicinity of the site during the field activities. Vehicles will be fueled off site.. Vehicle and equipment maintenance, if necessary during field activities, will occur inthe Building 570 complex. The proposed location for this activity will be at the Gilbane job site trailer area.

<u>Vehicle and Equipment Maintenance</u>

<u>Heavy Equipment and Vehicle-Related Lubricants</u>

All heavy equipment and vehicles will be inspected prior to use onsite and at the beginning of each workday for oil, lubricant, and hydraulic leaks. Leaking equipment will be repaired or removed from service, and small leaks will be cleaned up immediately. Excessive application of grease during equipment maintenance will be avoided, and accumulated grease will be wiped off. Contaminated rags will be disposed properly offsite. All oil and lubricant supplies will be stored securely in drums or bins to prevent an uncontrolled discharge of spilled materials.

<u>Passenger Vehicles and Trucks</u>

Passenger vehicles and trucks will be inspected daily for possible leaks, but any major service will be performed off site at commercial facilities.

To the extent practical, routine vehicle and equipment maintenance will be performed in established and permanent maintenance facilities. When required in the field, drip pans or absorbent pads will be used for all vehicle and equipment maintenance activities that involve grease, oil, solvents, coolants, or other vehicle/equipment fluids.

3.3.2 Materials Management and Waste Management

Materials management control practices consist of implementing procedural and structural BMPs for handling, storing, and using construction materials to prevent the release of those materials into stormwater discharges. The materials may be used continuously, such as fuel for vehicles and equipment, or the materials may be used for a discrete period, such as soil binders for temporary stabilization.

Waste management consists of procedural and structural BMPs for handling, storing, and ensuring proper disposal of wastes, to prevent the release of those wastes into stormwater discharge points.

Materials and waste management pollution control BMPs will be implemented to minimize stormwater contact with construction materials, wastes, and service areas, and to prevent materials and wastes from being discharged off site. The primary mechanisms for stormwater contact will include:

- Direct contact with precipitation.
- Contact with stormwater run-on and run-off.
- Wind dispersion of loose materials.
- Direct discharge to the storm drain system through spills or dumping.
- Extended contact with some materials and wastes, such as asphalt cold mix and treated wood products, which can leach pollutants into stormwater.

A list of construction activities is provided in Section 2.4. Table 3.5 identifies the BMPs that will be implemented (including WM BMPs) to handle materials and control construction site wastes associated with these construction activities. Fact Sheets for Materials and Waste Management BMPs are provided in Appendix C.

Table 3.5 Temporary Materials Management BMPs

CASQA Fact Sheet	BMP Name	Meets a Minimum Requirement[1]	BMP used		If not used, state reason
			YES	NO	
WM-01	Material Delivery and Storage	✓	✓		
WM-02	Material Use	✓	✓		
WM-03	Stockpile Management	✓	✓		
WM-04	Spill Preservation and Control	✓	✓		
WM-05	Solid Waste Management	✓	✓		
WM-06	Hazardous Waste Management	✓	✓		
WM-07	Contaminated Soil Management		✓		
WM-08	Concrete Waste Management	✓		✓	No concrete work in current SOW
WM-09	Sanitary-Septic Waste Management	✓	✓		
WM-10	Liquid Waste Management		✓		

Alternate BMPs Used:	If used, state reason:

[1] Applicability to a specific project will be determined by the QSD.

Material management BMPs will be implemented in conformance with the following guidelines and in accordance with the BMP Fact Sheets provided in Appendix C. If there is a conflict between documents, the RAWP will prevail over narrative in the body of the CERCLA SWP or guidance in the BMP Fact Sheets. The narrative in the body of the CERCLA SWP prevails over guidance in the BMP Fact Sheets.

Material Delivery and Storage

Material deliveries will be coordinated with the Site Superintendent and stored in a manner specified by the manufacturer. To prevent, reduce, or eliminate the discharge of pollutants from material delivery and storage to the stormwater system or watercourses, the following practices will be followed: minimize the storage of hazardous materials onsite, store materials in a designated area, install secondary containment for the storage area, conduct regular inspections, and train employees and subcontractors on material handling and storage. The materials will be stored at the onsite Gilbane office.

Material Use

Materials are to be used in the manner for which they were designed. Actions to prevent or reduce discharge of pollutants to the storm drain system or watercourses from material use include: using alternative products, minimizing hazardous material use onsite, and training employees and subcontractors.

To prevent chemical pollutants from entering the environment, hazardous materials will be stored in a central area at least 50 feet from surface waters. Containers will be stored properly when not in use and will be placed in the appropriate storage cabinet or secondary containment structure to reduce the risk of a fire or a release.

Stockpile Management

Stockpile management procedures and practices will be designed to reduce or eliminate air and stormwater pollution from stockpiles of soil. During excavation, backfilling, and grading, soils may be stockpiled in areas adjacent to that activity. Because the soil will be stockpiled in a generally uncompacted condition, it is subject to erosion. In addressing stockpiling, BMPs may include diversion of drainage from the stockpiles, installation of filter barriers on the downgradient toe of stockpile slope, and dust control. In addition, large stockpiles will be sloped to reduce the infiltration of rainwater. Stockpiles of excavated materials will be covered with 10-mililiter visqueen or soil stabilizing agent when not in use.

<u>Spill Preservation and Control</u>

The radiological surveys at NSTI will be conducted in accordance with the project-specific RAWP to which this SWP is an attachment, and the project-specific Accident Prevention Plan/Site Safety and Health Plan (Gilbane, 2018). These documents will be maintained on the Site, and outline the specific steps to be followed if a spill or release occurs. If changes or revisions to these documents are made, the most recent version will supersede the previous iteration.

Field practices will be implemented to prevent or reduce the discharge of pollutants to drainage systems or watercourses from leaks and spills.

The BMPs for spill prevention and control include the following.

- Train employees and subcontractors on how to reduce the chance and stop the source of the spills.
- Train employees and subcontractors on proper spill response procedures.
- Stop the source of a spill immediately, if safe to do so.
- If safe to do so, contain and clean up spills immediately and notify the Gilbane Superintendent immediately.
- Once contained train employees and subcontractors on proper disposal of spill material.
- Spills of hazardous materials that cannot be cleaned up or that have resulted in a release should be reported immediately to the Gilbane Superintendent, who will immediately notify the Navy, which in turn will be responsible for notifying the regulatory agencies as necessary and for managing cleanup.

<u>Solid Waste Management</u>

All construction waste generated from the building demolition such as scrap timber, steel, concrete, removed utility piping or demolished asphalt pavement, once surveyed for radiological contamination and cleared for release, will be disposed in dumpsters, roll-off bins, or other similarly approved containers in designated areas located throughout the Site. Specific procedures to handle all types of waste expected within Gilbane work areas at NSTI are included in the *Environmental Protection Plan, Radiological Management and Demolition Plan, and*

Waste Management Plan, which is part of the project-specific RAWP to which this SWP is an attachment (Gilbane, 2018a). Copies of these plans will be maintained at the Site.

Solid waste management procedures and practices are designed to prevent or reduce the discharge of pollutants to stormwater from solid or construction waste by providing designated waste collection areas and containers, arranging for regular disposal, and training employees and subcontractors.

Contaminated Soil Management

Stockpiles of excavated soil generated during the storm drain and sanitary sewer line removal activities will be stored in a designated storage area, the location of which will be authorized by the Caretaker Site Office (CSO). These contaminated soil management practices will be implemented during trench excavation, radiological screening, and stockpiling activities. The excavation activities require the use of a radiological screening pad, dewatering pad, low-level radiological waste/low-level mixed waste (LLRW/LLMW) staging area, and soil stockpile area for temporary storage of soils following excavation/screening and prior to re-use or offsite disposal.

The individual stockpiles will be limited to a maximum of approximately 500 cubic yards for proper stockpile management. All stockpiles will be covered with plastic sheeting at the end of each field day. Plastic sheeting will be suitably secured with sandbags to hold the sheeting in place. Any stormwater that comes into contact with the stockpiled soil will be contained to prevent erosion.

Open storm drain or sanitary sewer lines left in place during the removal process will be plugged to prevent water from entering or exiting the lines and to eliminate the release of any contamination that may be present in the lines.

Hazardous Waste Management

Potential hazardous wastes at the Site include contaminated soil and spills or releases of fuel, oil, and lubricants. Specific procedures to handle all types of waste expected at the Site have been developed by Gilbane and are included in the Waste Management Plan and Radiological Management and Demolition Plan, attached as Appendix B and Appendix E to the RAWP.

Sanitary-Septic Waste Management

Proper sanitary and septic waste management practices, consisting of providing convenient, well-maintained facilities, and arranging for regular service and disposal, will be implemented to prevent the discharge of pollutants to stormwater from sanitary and septic waste.

Liquid Waste Management

The implementation of liquid waste management will include procedures and practices to prevent the discharge of pollutants to the storm drain system or to watercourses as a result of the creation, collection, and disposal of non-hazardous liquid wastes. Wastewater that is generated by dewatering of an excavation will be stored in drums and will be chemically screened and characterized prior to disposal. Water from dust control activities, purge water from groundwater sampling, and decontamination water is collected in drums. The water is filtered or otherwise treated and sampled to verify compliance with the discharge permit prior to discharge to the onsite sanitary sewer treatment system.

These management practices will be implemented during removal activities and decontamination at all locations, and while other field activities are performed.

Liquid wastes will be profiled to verify compliance with the discharge permit for CERCLA contaminants for the onsite sanitary sewer treatment system. Non-compliant liquid waste will be disposed of off-site.

3.4 POST CONSTRUCTION STORMWATER MANAGEMENT MEASURES

Post-construction BMPs are permanent measures installed as part of the construction activities, and designed to reduce or eliminate pollutant discharges from the Site after construction is completed.

At the completion of construction activities at the SWDAs, the RSY pads will be demobilized and the SWDAs will be restored "in-kind" to grade and conditions equal to original conditions, unless noted otherwise.

For open areas previously covered with grass, an appropriate grass seed mix will be applied by hydro seeding or similar means to restore the area to compatible neighboring grasses. The seed mix will be consistent with those used previously at NSTI and will submitted to the Navy for concurrence prior to application.

The following source-control post-construction BMPs to comply with General Permit Section XIII.B and local requirements have been identified for the site:

- EC-2, Preservation of Existing Vegetation
- EC-4, Hydroseed

Open areas with disturbed soil will be hydroseeded (EC-4) to re-establish vegetation as necessary. No other stormwater management practices will be performed, as vegetation clearing and equipment movement will be minimized to maintain existing vegetation to the extent practical.

Section 4 BMP Inspection and Maintenance

4.1 BMP INSPECTION AND MAINTENANCE

The General Permit requires routine weekly inspections of BMPs, along with inspections before, during, and after qualifying rain events producing precipitation of 0.5 inch or more. A BMP inspection checklist will be filled out for inspections and maintained onsite with the CERCLA SWP. The inspection checklist includes the necessary information covered in Section 7.6. A blank inspection checklist is included in Appendix D. Completed checklists will be kept in a binder onsite in the Gilbane field office.

Components of the BMPs will be maintained regularly to ensure proper and effective functionality. If necessary, corrective actions will be implemented within 72 hours of identified deficiencies, and associated amendments to the CERCLA SWP will be prepared by the QSD.

Specific details for maintenance, inspection, and repair of Construction Site BMPs can be found in the BMP Factsheets in Appendix C.

Section 5 Training

Section 6 identifies the SWP Implementer and QSD for the project. To promote stormwater management awareness specific to this project, periodic training of job site personnel will be included as part of routine project meetings (e.g., daily/weekly tailgate safety meetings) or task-specific training as needed.

The SWP Implementer will be responsible for providing this information at the meetings, and subsequently completing the training logs provided in Appendix E, which identify the site-specific stormwater topics covered as well as the names of site personnel who attended the meeting. Specific stormwater management tasks may be delegated to trained employees by the SWP Implementer, under the condition that adequate supervision and oversight is provided. Training will correspond to the specific task delegated, including CERCLA SWP implementation, BMP inspection and maintenance, and recordkeeping.

Documentation of training activities (formal and informal) will be retained in a field binder located onsite in the Gilbane office.

Section 6 Responsible Parties and Operators

6.1 RESPONSIBLE PARTIES

Table 6.1 lists the project site personnel who will be responsible for CERCLA SWP activities, including the Project Manager, CERCLA SWPPP developer, and CERCLA SWPPP implementer.

Table 6.1 Responsible Parties for this CERCLA SWP

CERCLA SWPPP Development and Revision Contact		
Cenk Ergin, P.E., QSD	Gilbane Project Engineer	925-946-3260
CERCLA SWPPP Implementer Contact		
Tony Olmstead, QSP	Gilbane Site Superintendent	925-250-7875
Project Manager		
John Baur	Gilbane Project Manager	925-382-3051

The CERCLA SWPPP implementer identified for the project will have primary responsibility and significant authority for the implementation, maintenance, and inspection and monitoring of CERCLA SWP requirements. The CERCLA SWPPP implementer will be available at all times throughout the duration of the project. Duties of the CERCLA SWPPP implementer include, but are not limited to, the following.

- Implementing all elements of the CERCLA SWP, including, but not limited to:
  - Ensuring that all BMPs are implemented, inspected, and properly maintained.
  - Performing non-stormwater and stormwater visual observations and inspections.
  - Performing routine inspections and observations.
  - Directing non-stormwater management, and materials and waste management activities such as: monitoring discharges; general Site clean-up; vehicle and equipment cleaning, fueling, and maintenance; spill control; ensuring that no materials other than stormwater are discharged in quantities that will have an adverse effect on receiving waters or storm drain systems.
- Ensuring elimination of unauthorized discharges.
- Mobilizing crews to make immediate repairs to the control measures.
- Coordinating with the contractor(s) to assure all necessary corrections/repairs are made immediately and that the project complies with the CERCLA SWP at all times.
- Notifying the QSP immediately of off-site discharges or other non-compliance events.

The implementer may delegate these inspections and activities to an appropriately trained employee, but will ensure adequacy of implementation and adequate deployment.

Section 7 Construction Site Monitoring Program

7.1 PURPOSE

This Construction Site Monitoring Program (CSMP) was developed to:

1. Determine whether non-visible pollutants are present at the construction site and are causing or contributing to exceedances of water quality objectives.
2. Determine whether immediate corrective actions, additional BMP implementation, or CERCLA SWP revisions are necessary to reduce pollutants in stormwater discharges and authorized non-stormwater discharges.
3. Determine whether BMPs included in the CERCLA SWP are effective in preventing or reducing pollutants in stormwater discharges and authorized non-stormwater discharges.

Gilbane will ensure that all specific monitoring requirements for the scoping activities at NSTI are implemented as stated in this Site-Specific CERCLA SWP.

7.2 APPLICABILITY OF PERMIT REQUIREMENTS

This project does not require any construction permit due to the disturbed area being less than 1 acre; therefore, this SWP identifies the following types of monitoring as being applicable for this project.

- Visual inspections of BMPs.
- Visual monitoring of the site related to qualifying storm events.
- Visual monitoring of the site for non-stormwater discharges.
- Sampling and testing in the event of breach of BMPs

7.3 WEATHER AND RAIN EVENT TRACKING

Visual monitoring and inspection requirements are triggered by a qualifying rain event. The General Permit defines a qualifying rain event as any event that produces 0.5 inch of precipitation within a 24-hour period. A minimum of 48 hours of dry weather will be used to distinguish between separate qualifying storm events.

7.3.1 Weather Tracking

The implementer should consult the National Oceanic and Atmospheric Administration (NOAA) daily for the weather forecasts. These forecasts can be obtained at http://www.srh.noaa.gov/.

7.3.2 Rain Gauges

Rain gauge readings will be recorded in daily contractor quality control reports. The nearest appropriate governmental rain gauge is located at the San Francisco International Airport (SFO), approximately 10 miles south of NSTI. The SFO rain gauge is maintained by the National Weather Service and hourly readings can be found at: www.weather.gov/data/obhistory/KSFO.html.

7.4 MONITORING LOCATIONS

Monitoring locations will vary depending on where work is being performed at the time of monitoring. Monitoring locations are described in the Sections 7.6.5 and 7.7.5

7.5 SAFETY AND MONITORING EXEMPTIONS

Safety practices for sample collection will be implemented in accordance with the *Site Safety and Health Plan* (Gilbane, 2018). Trips, slips, and falls are the primary safety hazard for performing visual monitoring. If a significant rainfall event (50 percent probability of 0.5 inches of precipitation or more within a 24-hour period) is anticipated for a work day, stormwater monitoring will be discussed as part of the tailgate safety meeting at the beginning of the work day.

This project is not required to conduct visual observations (inspections) under the following conditions.

- During dangerous weather conditions such as flooding and electrical storms.
- Outside of scheduled Site business (work) hours.

Scheduled Site business (work) hours are Monday through Friday 6:30 a.m. to 5 p.m.

If visual monitoring of the Site is unsafe because of the dangerous conditions noted above, then the implementer will document the conditions for why an exception to performing the monitoring was necessary. Field daily reports stating the reasons for an exception to performing the monitoring can be utilized as backup exemption documentation. The exemption documentation will be kept in a binder located at the Gilbane field office.

7.6 VISUAL MONITORING

Visual monitoring includes observations and inspections. Inspections of BMPs are required to identify and record BMPs that need maintenance to operate effectively, that have failed, or that could fail to operate as intended. Visual observations of the Site are required to observe stormwater drainage areas, and to identify any spills, leaks, or uncontrolled pollutant sources.

Table 7.1 identifies the required frequency of visual observations and inspections. Inspections and observations will be conducted at the locations identified in Section 7.6.1 and Section 7.6.2.

Table 7.1 Summary of Visual Monitoring and Inspections

Type of Inspection	**Frequency**
Routine Inspections	
BMP Inspections	Weekly[1]
BMP Inspections – Tracking Control	Daily
Non-Stormwater Discharge Observations	Quarterly
Rain Event Triggered Inspections	
Site Inspections Prior to a Qualifying Event	Within 48 hours of a qualifying event[2]
BMP Inspections During an Extended Storm Event	Every 24-hour period of a rain event[2]
Site Inspections Following a Qualifying Event	Within 48 hours of a qualifying event[2]

[1] BMPs must be inspected weekly, except for those identified to be inspected more frequently.

[2] Inspections are only required during scheduled Site operating hours.

7.6.1 Routine Observations and Inspections

Routine Site inspections and visual monitoring are necessary to ensure that the project is in compliance with the applicable requirements of a General Permit.

7.6.1.1 Routine BMP Inspections

Inspections of BMPs are conducted to identify and record:

- BMPs that are properly installed.
- BMPs that need maintenance to operate effectively.
- BMPs that have failed.
- BMPs that could fail to operate as intended.

7.6.1.2 Non-Stormwater Discharge Observations

Each drainage area will be inspected for the presence of, or indications of, prior unauthorized and authorized non-stormwater discharges. The following inspection findings will be recorded.

- Presence or evidence of any non-stormwater discharge (authorized or unauthorized).
- Pollutant characteristics (floating and suspended material, sheen, discoloration, turbidity, odor, etc.).
- Source of discharge.

7.6.2 Rain-Event Triggered Observations and Inspections

Visual observations of the Site and inspections of BMPs will be conducted prior to a qualifying rain event, following a qualifying rain event, and every 24-hour period during a qualifying rain event. Pre-rain inspections will be conducted after consulting NOAA and determining that a precipitation event with a 50 percent probability of 0.5 inch of precipitation or more within a 24-hour period has been predicted.

7.6.2.1 Visual Observations Prior to a Forecasted Qualifying Rain Event

Within 48 hours prior to a qualifying event, a stormwater visual monitoring Site inspection will include observations of the following locations:

- Stormwater drainage areas to identify any spills, leaks, or uncontrolled pollutant sources.
- Location of each BMP to verify proper installation or implementation, appropriate maintenance, and suitable integrity to perform as intended during the qualifying event.
- Any non-stormwater storage and containment areas to detect leaks and ensure maintenance of adequate height side of containment.

7.6.2.2 BMP Inspections During an Extended Storm Event

During an extended rain event (multiple consecutive 24-hour periods with 0.5 inch or more of rain), BMP inspections will be conducted to identify and record:

- BMPs that are properly installed.
- BMPs that need maintenance to operate effectively.
- BMPs that have failed.
- BMPs that could fail to operate as intended.

If the construction site is not accessible during the rain event, the visual inspections will be performed at all relevant outfalls, discharge points, and downstream locations. The inspections should record any projected maintenance activities.

7.6.2.3 Visual Observations Following a Qualifying Rain Event

Within 48 hours following a qualifying rain event (0.5 inch of rain within a 24-hour period) a stormwater visual monitoring Site inspection is necessary to observe:

- Stormwater drainage areas to identify any spills, leaks, or uncontrolled pollutant sources.
- Location of each BMP to verify proper installation or implementation, appropriate maintenance, and suitable integrity to perform as intended during the qualifying event.
- Need for additional BMPs.
- Any non-stormwater storage and containment areas to detect leaks and ensure maintenance of adequate freeboard.
- Discharge of stored or contained rain water.

7.6.3 Visual Monitoring Procedures

Visual monitoring will be conducted by the Qualified SWPPP Practitioner (QSP), or by staff trained by and under the supervision of the QSP.

The name(s) and contact number(s) of the site visual monitoring personnel are listed below. Their training qualifications are provided in Appendix F.

Assigned inspector:	Tony Olmstead	Contact phone: 925-250-7875
Alternate inspector:	Teresa Ruha	Contact phone: 925-525-8210

Stormwater observations will be documented on the Visual Inspection Field Log Sheet (Appendix D, Inspection Forms). BMP inspections will be documented on the site-specific BMP inspection checklist.

Within 2 days of the inspection, the implementer will submit copies of the completed inspection report to the Navy. The completed reports will be kept in a binder located onsite in the Gilbane field office. Any photographs used to document observations will be referenced on the stormwater site inspection report and will be included in the Daily Production Reports.

7.6.4 Visual Monitoring Follow-Up and Reporting

Correction of deficiencies identified by the observations or inspections, including required repairs or maintenance of BMPs, will be initiated and completed as soon as possible.

If identified deficiencies require design changes, including additional BMPs, changes will be initiated within 72 hours of identification and be completed as soon as practical. When design changes to BMPs are required, the CERCLA SWP will be amended to reflect the changes.

Deficiencies identified in site inspection reports and correction of deficiencies will be tracked on the Inspection Field Log Sheet or BMP Inspection Report and will be submitted to the SWPPP implementer and will be kept in a binder located onsite in the Gilbane field office.

7.6.5 Visual Monitoring Locations

The inspections and observations identified in Sections 7.6.1 and 7.6.2 will be conducted at all trench excavations and stockpile locations identified on Figures 2 and 3.

Due to the current scope of work, there will be no discharge from the trench excavation areas. Therefore, there will not be any drainage areas identified. Potential discharge point locations were identified on the Site based on the possibility of a breach/malfunction in the installed BMPs during a storm event.

7.7 WATER QUALITY SAMPLING AND ANALYSIS

Sampling and testing of stormwater runoff will occur only if the visual monitoring indicates possible pollution due to breach/malfunction of BMPs. If suspended particulate matter is observed in the stormwater runoff, a sufficient sample volume will be collected and the turbidity and pH of the water measured in the field using a multi-parameter water quality meter (YSI 600XL or equivalent suitable for measuring pH, temperature, dissolved oxygen, salinity, and turbidity) following procedures as established by the manufacturer of the meter. Results of the field tests, including the time and location of sample collection, will be recorded on a Sampling Log Sheet (Appendix D). Following this initial sampling and analysis, a follow-up visual inspection will be conducted, and sampling and testing will be performed if visible pollutants are observed, at 2-hour intervals during the remainder of the business hours, unless rainfall and runoff have ceased. If stormwater discharge continues to be observed on the subsequent business day(s), the visual monitoring, sampling, and testing will be performed at the beginning of business hours and repeated 6 hours later, unless rainfall and run-off have ceased.

If an oily sheen is observed from the visual monitoring of the stormwater runoff, sufficient stormwater to fill two 1-liter glass jars will be collected and analyzed following procedures described in Section 7.7.1.

7.7.1 Sampling and Analysis Plan for Non-Visible Pollutants in Stormwater Runoff Discharges

This Sampling and Analysis Plan for Non-Visible Pollutants describes the sampling and analysis strategy and schedule for monitoring non-visible pollutants in stormwater runoff discharges from the project site.

Sampling for non-visible pollutants will be conducted when (1) a breach, leakage, malfunction, or spill is observed or known to have occurred; (2) the leak or spill has not been cleaned up prior to the rain event; and (3) there is the potential for discharge of non-visible pollutants to surface waters or a drainage system.

The following construction materials, wastes, or activities, as identified in Section 2.5, are potential sources of non-visible pollutants to stormwater discharges from the project.

- Fuel.
- Sanitary septic from portable toilets.
- Equipment decontamination water
- Uncovered stockpile material with contaminated soil

Based on the discussion of stormwater run-on in Section 2.2, stormwater run-on is not anticipated from locations without known potential to contribute non-visible pollutants to stormwater discharges from the project site.

7.7.1.1 Sampling Schedule

Collection of discharge samples for non-visible pollutant monitoring will be triggered when any of the following conditions are observed during site inspections conducted prior to or during a significant rain event.

- Materials or wastes containing potential non-visible pollutants are not stored under watertight conditions. Watertight conditions are defined as (1) storage in a watertight container, (2) storage under a watertight roof or within a building, or (3) protected by temporary cover and containment that prevents stormwater contact and runoff from the storage area.
- Materials or wastes containing potential non-visible pollutants are stored under watertight conditions, but (1) a breach, malfunction, leakage, or spill is observed, (2) the leak or spill is not cleaned up prior to the rain event, and (3) there is the potential for discharge of non-visible pollutants to surface waters or a storm drain system.
- A construction activity including, but not limited to, those in Section 2.5, with the potential to contribute non-visible pollutants (1) was occurring during or within 24 hours prior to the rain event, (2) BMPs were observed to be breached, malfunctioning, or improperly implemented, and (3) there is the potential for discharge of non-visible pollutants to surface waters or a storm drain system.
- Stormwater runoff from an area contaminated by historical usage of the site has been observed to combine with stormwater runoff from the site, and there is the potential for discharge of non-visible pollutants to surface waters or a storm drain system.

7.7.1.2 Sampling Locations

Sampling locations are based on proximity to the storage or use of non-visible pollutants; accessibility for sampling; and personnel safety. Planned non-visible pollutant sampling locations are shown on Figure 3 and Table 7.2 and 7.3.

One sampling location on the project site and the contractor's yard has been identified for the collection of samples of runoff from planned material and waste storage areas, and areas where non-visible pollutant-producing construction activities are planned.

Table 7.2 Non-Visible Pollutant Sample Locations – Contractors' Yard

Sample Location Number	**Sample Location Description**	**Sample Location Latitude and Longitude** (Decimal Degrees)
SP-1	Laydown and Refueling Area, Staging/ Material Storage/Vehicle Storage/ Portable Toilet Storage Area	37°49'41.23"N 122°22'10.19"W

One sampling location has been identified for the collection of samples of runoff from drainage areas contaminated by historical usage of the site.

Table 7.3 Non-Visible Pollutant Sample Locations – Areas of Historical Contamination

Sample Number	Sample Location	Sample Location Latitude and Longitude (Decimal Degrees)
SP-2	South of Bldg. 461	37°49'52.32"N 122°22'15.82"W
SP-3	North of Bldg. 1202	37°49'45.97"N 122°22'33.74"W
SP-4	South of Bldg. 1129	37°49'41.23"N 122°22'37.80"W

One sampling location has been identified for the collection of an uncontaminated sample of runoff as a background sample for comparison with the samples being analyzed for non-visible pollutants. This location was selected so the sample will not have come in contact with the operations, activities, or areas identified in Section 7.7.1 or with disturbed soils areas.

Table 7.4 Non-Visible Pollutant Sample Locations – Background (Unaffected Sample)

Sample Location Number	Sample Location	Sample Location Latitude and Longitude (Decimal Degrees)
SP-5	North West of Bldg. 225	37°49'31.12"N 122°22'33.85"W

If a stormwater visual monitoring site inspection conducted prior to or during a storm event identifies the presence of a material storage, waste storage, or operations area with spills or the potential for the discharge of non-visible pollutants to surface waters, or to a storm drain system that is at a location not listed above and has not been identified on the site maps, sampling locations will be selected by the SWPPP implementer using the same rationale as that used to identify planned locations. Non-visible pollutant sampling locations will be identified by the SWPPP implementer on the pre-rain event inspection form prior to a forecasted qualifying rain event.

7.7.1.3 Monitoring Preparation

Non-visible pollutant samples will be collected by:

Contractor ☒ Yes ☐ No

Consultant ☐ Yes ☒ No

Laboratory ☐ Yes ☒ No

Samples on the Site will be collected by the following contractor sampling personnel:

Name/Telephone Number: Tony Olmstead / 925-250-7875
Alternate(s)/Telephone Number: Teresa Ruha / 925-525-8210

An adequate stock of monitoring supplies and equipment for monitoring non-visible pollutants will be available on the Site prior to a sampling event. Monitoring supplies and equipment will be stored in a cool environment that will not come into contact with rain or direct sunlight. Sampling personnel will be available to collect samples in accordance with the sampling schedule. Supplies maintained at the project Site will include, but are not limited to, clean powder-free nitrile gloves, sample collection equipment, coolers, an appropriate number and volume of sample bottles, identification labels, re-sealable storage bags, paper towels, personal rain gear, and ice.

7.7.1.4 Analytical Constituents

Table 7.5 lists the specific sources and types of potential non-visible pollutants on the project site and the water quality indicator constituent(s) for that pollutant.

Table 7.5 Potential Non-Visible Pollutants and Water Quality Indicator Constituents

Pollutant Source	Pollutant	Water Quality Indicator Constituent
Antifreeze and Other Vehicle Fluids	Visually Observable – No Testing Required	
Batteries	Sulfuric acid, lead, pH	Lead, sulfate, or pH
Contaminated Soil	Polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), Pesticides [(2)], Lead, Chromium	PCBs, PAHs, [(1)], Pesticides[(2)], Lead, Chromium
Oily wastes	Petroleum products, PAHs, PCBs	Extractable petroleum hydrocarbons, PCBs, PAHs [(1)]
Radioactive Impacted Soil	radionuclides of concern (ROC; i.e., radium-226)	No testing required.

[(1)] PAHs and PCBs may not be visible, and stormwater discharge contacting subsurface soil will be analyzed for PCBs and PAHs.
[(2)] Pesticides will be analyzed for 4,4-DDD and alpha-BHC only

7.7.1.5 Sample Collection

Samples of discharge will be collected at the designated non-visible pollutant sampling locations shown on Figure 3 and listed in Section 7.7.1.2, or at the locations determined by observed breaches, malfunctions, leakages, spills, operational areas, soil amendment application areas, and historical site usage areas that triggered the sampling event.

Grab samples will be collected and preserved in accordance with the methods identified in Table 7.6. Only the SWPPP implementer, or personnel trained in water quality sampling under the direction of the SWPPP implementer, will collect samples.

Sample collection and handling requirements are described in Section 7.7.5.

7.7.1.6 Sample Analysis

Samples will be analyzed using the analytical methods identified in Table 7.6. Samples will be analyzed by:

Laboratory Name:	Test America Laboratory
Street Address:	13715 Rider Trail North
City, State Zip:	Earth City, MO 63045
Telephone Number:	(314) 787-8227
Point of Contact:	Rhonda Ridenhower
ELAP Certification Number:	2886

Table 7.6 Sample Collection, Preservation and Analysis for Monitoring Non-Visible Pollutants

Constituent	Analytical Method	Minimum Sample Volume	Sample Containers	Sample Preservation	Reporting Limit	Maximum Holding Time
TPH – Diesel and Motor Oil Range Organics	EPA 8015B; prep by EPA 3510C/3520C	2 x 1 liter	1.0-liter amber glass with Teflon liners	Store at 4°C	50 ug/L	Extraction – 14 days Analysis – 40 days
PAHs	EPA 8270 SIM	1 x 1 liter	Glass-Amber	Store at 4°C	10 ug/L	7 days
Metals (Chromium, Lead)	EPA 6010C / 6020A[4]	500 mL[7]	Plastic	HNO_3 and 4°C	5 ug/L	180 days
Pesticides / PCBs	EPA 8081A / 8082	1 x 1 liter	Glass-Amber	Store at 4°C	0.1 ug/L	7 days

Notes:

1. Analyses for non-visible pollutants only performed if conditions or observations identified in Section 7.6.1.2 occur.

Abbreviations used in table:

ºC = degrees Celsius
HNO_3 = nitric acid
mL = milliliter(s)
SIM = selective ion monitoring
ug/L = micrograms per liter

7.7.1.7 Data Evaluation and Reporting

The SWPPP implementer will complete an evaluation of the water quality sample analytical results within 48 hours of receiving data.

Runoff/downgradient results will be compared with the associated upgradient/unaffected results and any associated run-on results. Should the runoff/downgradient sample show an increased level of the tested analyte relative to the unaffected background sample, which cannot be explained by run-on results, the BMPs, site conditions, and surrounding influences will be assessed to determine the probable cause for the increase.

As determined by the site and data evaluation, appropriate BMPs will be repaired or modified to mitigate discharges of non-visible pollutant concentrations. Any revisions to the BMPs will be recorded as an amendment to the CERCLA SWP.

The General Permit prohibits stormwater discharges that contain hazardous substances equal to or in excess of reportable quantities established in 40 Code of Federal Regulations (CFR) §§ 117.3 and 302.4. The results of any non-stormwater discharge results that indicate the presence of a hazardous substance in excess of established reportable quantities will be reported to the RWQCB and other agencies immediately, as required by 40 CFR §117.3 and §302.4.

7.7.2 Sampling and Analysis Plan for pH and Turbidity in Stormwater Runoff Discharges

Sampling and analysis of runoff for pH and turbidity is not required for this project.

7.7.3 Sampling and Analysis Plan for Non-Stormwater Discharges

This Sampling and Analysis Plan for non-stormwater discharges describes the sampling and analysis strategy and schedule for monitoring pollutants in authorized and unauthorized non-stormwater discharges from the project site in accordance with the requirements of the General Permit.

Sampling of non-stormwater discharges will be conducted when an authorized or unauthorized non-stormwater discharge is observed on the project Site. In the event that non-stormwater discharges run-on to the project Site from off-site locations, and this run-on has the potential to contribute to a violation of a numeric action level (NAL), the run-on also will be sampled.

The following authorized non-stormwater discharges identified in Section 2.5, have the potential to be discharged from the project site.

- Water to control dust.

In addition to the above authorized non-stormwater discharges, some construction activities have the potential to result in an unplanned (unauthorized) non-stormwater discharge if BMPs fail. These activities include:

- Water from equipment decontamination.
- Fuel or oil (leaks from fueling operation).

7.7.3.1 Sampling Schedule

Samples of authorized or unauthorized non-stormwater discharges will be collected when they are observed.

7.7.3.2 Sampling Locations

Samples will be collected from the point of non-stormwater release, as well as the discharge point of the construction site where the non-stormwater discharge is running off the project Site. Approximate sample locations are shown on Figure 3 and include the locations identified below.

Three sampling locations on the project Site have been identified where non-stormwater discharges may run off from the project site. However, if a non-stormwater discharge is running off the project Site at a location other than those described below, samples will be collected from the actual discharge location.

Table 7.7 Non-Stormwater Discharge Sample Locations

Sample Location Number	**Sample Location**[1]	**Sample Location Latitude and Longitude** (Decimal Degrees)
SP-1	Gilbane Trailer / Office	37°49'41.23"N 122°22'10.19"W
SP-2	South of Bldg. 461	37°49'52.32"N 122°22'15.82"W
SP-3	North of Bldg. 1202	37°49'45.97"N 122°22'33.74"W
SP-4	South of Bldg. 1129	37°49'41.23"N

Sample Location Number	Sample Location[1]	Sample Location Latitude and Longitude (Decimal Degrees)
		122°22'37.80"W
SP-5	North West of Bldg. 225	37°49'31.12"N 122°22'33.85"W

[1] If the non-stormwater discharge is running off the project Site at a location other than those described in the table, samples will be collected from the actual discharge location.

7.7.3.3 Monitoring Preparation

Non-stormwater discharge samples will be collected by:

Contractor	☒ Yes	☐ No
Consultant	☐ Yes	☒ No
Laboratory	☐ Yes	☒ No

Samples on the project site will be collected by the following contractor sampling personnel:

Name/Telephone Number: Tony Olmstead / 925-250-7875

Alternate(s)/Telephone Number: Teresa Ruha / 925-525-8210

An adequate stock of monitoring supplies and equipment for monitoring non-stormwater discharges will be available on the project site. Monitoring supplies and equipment will be stored in a cool temperature environment that will not come into contact with rain or direct sunlight. Personnel trained in sampling will be available to collect samples in accordance with the sampling schedule. Supplies maintained at the project Site will include, but are not limited to, clean powder-free nitrile gloves, sample collection equipment, coolers, the appropriate number and volume of sample bottles, identification labels, re-sealable storage bags, paper towels, personal rain gear, and ice.

The contractor will obtain and maintain the field testing instruments, as identified in Section 7.7.3, for analyzing samples in the field by the contractor's sampling personnel.

7.7.3.4 Analytical Constituents

All non-stormwater discharges that flow through a disturbed area will, at minimum, be monitored for turbidity and pH.

Non-stormwater discharge run-on will be monitored, at minimum, for pH and turbidity. The SWPPP implementer will identify additional pollutants to be monitored for each non-stormwater discharge incident based on the source of the non-stormwater discharge. If the source of an unauthorized non-stormwater discharge is not known, monitoring for pH, turbidity, methylene blue active substance, total organic content, and residual chlorine or chloramines is recommended to help identify the source of the discharge.

Table 7.8 lists the specific sources and types of potential non-visible pollutants on the project site and the water quality indicator constituent(s) for that pollutant.

Table 7.8 Potential Non-Stormwater Discharge Pollutants and Water Quality Indicator Constituents

Pollutant Source	Pollutant	Water Quality Indicator Constituent
Equipment Operation	Petroleum Hydrocarbons	TPH – Gasoline, Diesel, and Motor Oil Range Organics (TPH-g, TPH-d, TPH-mo)
Equipment Maintenance	Petroleum Hydrocarbons	TPH-g, TPH-d, TPH-mo
Equipment Washing	Petroleum Hydrocarbons	TPH-g, TPH-d, TPH-mo
Equipment Fueling	Petroleum Hydrocarbons	TPH-g, TPH-d, TPH-mo

7.7.3.5 Sample Collection

Grab samples will be collected and preserved in accordance with the methods identified in Table 7.9. Only personnel trained in water quality sampling under the direction of the SWPPP implementer will collect samples.

Sample collection and handling requirements are described in Section 7.7.5.

7.7.3.6 Sample Analysis

Samples will be analyzed using the analytical methods identified in Table 7.9.

7.7.3.7 Data Evaluation and Reporting

The SWPPP implementer will complete an evaluation of the water quality sample analytical results.

Runoff results will also be evaluated for the constituents suspected in the non-stormwater discharge. Should the runoff sample indicate the discharge of a pollutant that cannot be explained by run-on results, the BMPs, site conditions, and surrounding influences will be assessed to determine the probable cause for the increase.

As determined by the site and data evaluation, appropriate BMPs will be repaired or modified to mitigate discharges of non-visible pollutant concentrations. Any revisions to the BMPs will be recorded as an amendment to the CERCLA SWP.

The General Permit prohibits non-stormwater discharges that contain hazardous substances at levels equal to or in excess of reportable quantities established in 40 CFR §117.3 and §302.4. Any non-stormwater discharge results that indicate the presence of a hazardous substance in excess of established reportable quantities will be immediately reported to the RWQCB.

Table 7.9 Sample Collection, Preservation and Analysis for Monitoring Pollutants in Non-Stormwater Discharges

Constituent	EPA Analytical Method	Minimum Sample Volume	Sample Bottle	Sample Preservation	Reporting Limit	Maximum Holding Time
TPH-g	8015B (Modified)	40 mL	3 x 40 mL VOA vial	HCL and 4ºC	50 ug/L	14 Days
TPH-d	8015B (Modified)	1 L	2 x 1 L Amber	4ºC	50 ug/L	7 Days
TPH-mo	8015B (Modified)	1 L	2 x 1 L Amber	4ºC	300 ug/L	7 Days

Notes:

VOA = volatile organic analysis
HCL = hydrochloric acid

7.7.4 Sampling and Analysis Plan for Other Pollutants Required by the Regional Water Quality Control Board

The RWQCB has not specified monitoring for additional pollutants.

7.7.5 Sample Collection and Handling

7.7.5.1 Sample Collection

Samples will be collected at the designated sampling locations shown on Figure 3 and listed in the preceding sections. To maintain sample integrity and prevent cross-contamination, sample collection personnel will follow the protocol below.

- Collect samples (for laboratory analysis) only in clean analytical laboratory-provided sample containers.
- Wear clean, powder-free nitrile gloves when collecting samples.
- Change gloves whenever something not known to be clean has been touched.
- Change gloves between sampling locations.
- Decontaminate all equipment (e.g. bucket, tubing) prior to sample collection using a phosphate-free detergent (e.g., Liquinox®) water wash, potable water rinse, and final rinse with distilled water. Decontamination water will be collected and properly disposed (i.e., not discharged to storm drain or receiving water). Laboratory-provided clean, sample bottles will not be decontaminated.
- Do not smoke during sampling events.
- Never sample near a running vehicle.
- Do not park vehicles in the immediate sample collection area (even non-running vehicles).
- Do not eat or drink during sample collection.
- Do not breathe, sneeze, or cough in the direction of an open sample container.

The most important aspect of grab sampling is to collect a water sample that represents the runoff stream at the time of sampling. Typically, samples are collected by dipping the collection container in the runoff flow paths and streams as noted below.

- For small streams and flow paths, simply dip the bottle facing upstream until full.
- For a larger stream that can be safely accessed, collect a sample in the middle of the flow stream by directly dipping the mouth of the bottle, once again making sure that the opening of the bottle is facing upstream to avoid any contamination by the sampler.

- For larger streams that cannot be safely entered, use a pole-sampler to safely access the middle of the flow stream to collect a representative sample.
- Avoid collecting samples from ponded, sluggish, or stagnant water.
- Avoid collecting samples directly downstream from a bridge, as the samples can be affected by the bridge structure or runoff from the road surface.

Note that, depending upon the specific analytical test, some containers may contain preservatives. These containers should **never** be dipped into the runoff stream, but filled indirectly from the container used to collect the water sample from the runoff stream.

7.7.5.2 Sample Handling

Samples for laboratory analysis will be handled as follows. Immediately following sample collection, the sampler will:

- Cap the sample container.
- Label the sample container.
- Seal the container in a re-sealable storage bag.
- Place storage bags with sample containers into an ice-chilled cooler.
- Document sample information on the Effluent Sampling Field Log Sheet.
- Complete the chain-of-custody (COC) documentation.

All samples for laboratory analysis will be maintained between 2 and 6 ºC during delivery to the laboratory. Samples will be kept on ice, or refrigerated, from the time of sample collection through delivery to the laboratory. Samples to be shipped will be placed inside coolers with ice ensuring that the sample bottles are well packaged to prevent breakage and cooler lids will be secured with packaging tape.

Samples for laboratory analysis will be shipped by overnight carrier or delivered to the analytical laboratory by a courier within 24 hours of sample collection. Holding times are measured from the time the sample is collected to the time the sample is analyzed. The analytical laboratory is identified below.

Laboratory Name:	Test America Laboratory
Street Address:	13715 Rider Trail North
City, State Zip:	Earth City, MO 63045

Telephone Number: (314) 787-8227

Point of Contact: Rhonda Ridenhower

7.7.5.3 Sample Documentation Procedures

Information entries on sample bottle identification labels, the Effluent Sampling Field Log Sheet, and Chain of Custody (COC) documentation will be completed using waterproof ink. These labels and documents will be considered accountable documents. If an error is made on an accountable document, the individual will make corrections by lining through the error and entering the correct information. The erroneous information will not be obliterated. All corrections will be initialed and dated.

Duplicate samples will be identified consistent with the numbering system for other samples to prevent the laboratory from identifying duplicate samples. Duplicate samples will be identified in the Effluent Sampling Field Log Sheet.

Sample documentation procedures include the following:

- Sample Bottle Identification Labels: Sampling personnel will attach an identification label to each sample bottle. The sample identification number will identify each sample collection location uniquely.
- Field Log Sheets: Sampling personnel will appropriately complete the Effluent Sampling Field Log Sheet and Receiving Water Sampling Field Log Sheet for each sampling event.
- Chain of Custody: Sampling personnel will prepare a COC form for each sampling event for which samples are collected for laboratory analysis. Both the sampler and the receiving party will sign and date the COC when the samples are turned over to the testing laboratory or courier.

7.8 QUALITY ASSURANCE AND QUALITY CONTROL

An effective Quality Assurance and Quality Control (QA/QC) plan (Appendix C of the RAWP) will be implemented to ensure that analytical data can be used with confidence. QA/QC procedures to be initiated include the following:

- Completion of field logs.
- Implementation of “clean” sampling techniques.
- Collection of QA/QC Samples.
- Data verification.

Each of these procedures is discussed in more detail in the following sections.

7.8.1 Field Logs

The purpose of field logs is to record sampling information and field observations during the collection of samples that may explain any uncharacteristic analytical results. Sampling information to be included in the field log includes the date and time of water quality sample collection, sampling personnel, sample container identification numbers, and the types of samples that were collected. Field observations should be noted in the field log, including any abnormalities at the sampling location (color, odor, BMPs, etc.). Field measurements for pH and turbidity also should be recorded in the field log. A Visual Inspection Field Log is included in Appendix D, Inspection Forms.

7.8.2 Clean Sampling Techniques

Clean sampling techniques involve the use of certified clean containers for sample collection and clean powder-free nitrile gloves during sample collection and handling. Adoption of a clean sampling approach will minimize the chance of field contamination and questionable data results.

7.8.3 Chain of Custody

The sample COC is an important documentation step that tracks samples from collection through analysis to ensure the validity of the sample. Sample COC procedures include the following:

- Proper labeling of samples.
- Completion of COC forms for all samples submitted for laboratory analysis.
- Prompt sample delivery to the analytical laboratory.

An example COC is included in the Sampling and Analysis Plan (Appendix B of the RAWP).

7.8.4 QA/QC Samples

QA/QC samples provide an indication of the accuracy and precision of the sample collection; sample handling; field measurements; and analytical laboratory methods.

The following types of QA/QC will be conducted for this project:

☒ Field duplicates at a minimum frequency of one duplicate per sampling event. (Required for all sampling plans with field measurements or laboratory analysis.)

☐ Equipment blanks at a frequency of 5 percent.
(Only needed if equipment used to collect samples could add the pollutants to sample.)

☐ Field blanks at a frequency of 5 percent.
(Only required if sampling method calls for field blanks.)

☒ Travel blanks for each cooler containing samples for volatile organic compound (VOC) or TPH-g analysis
(Required for sampling plans that include VOC or TPH-g laboratory analysis.)

7.8.4.1 Field Duplicates

Field duplicates provide verification of laboratory or field analysis and sample collection. Duplicate samples will be collected, handled, and analyzed using the same protocols as primary samples. The sample location where field duplicates are collected will be randomly selected from the discharge locations. Duplicate samples will be collected immediately after the primary sample has been collected. Duplicate samples must be collected in the same manner and as close in time and location as possible to the original sample.

7.8.4.2 Equipment Blanks

Equipment blanks provide verification that equipment has not introduced a pollutant into the sample. Equipment blanks typically are collected when any of the following applies:

- New equipment is used.
- Equipment has been cleaned after use at a contaminated site.
- Equipment that is not dedicated for surface water sampling is used.
- A new lot of filters is used when sampling metals.

7.8.4.3 Field Blanks

Field blanks assess potential sample contamination levels that occur during field sampling activities. Deionized water field blanks are taken to the field, transferred to the appropriate container, and treated the same as the corresponding sample type during the course of a sampling event.

7.8.4.4 Travel Blanks

Travel blanks (also known as trip blanks) assess the potential for cross-contamination of VOCs between sample containers during shipment from the field to the laboratory. Travel blanks are prepared by the analytical laboratory using water free of VOCs and provided to the contractor. When samples are collected for analysis of VOCs, such as TPH-g, travel blanks are placed in the same cooler as the field samples for VOC analysis.

7.8.5 Data Verification

After results are received from the analytical laboratory, the Project Chemist will verify the data to ensure that it is complete, accurate, and the appropriate QA/QC requirements were met. Data must be verified as soon as the data reports are received. Results will be included in the Remedial Action Completion Report.

Data verification will include:

- Check the COC and laboratory reports to verify that all requested analyses were performed and all sample analytical results are accounted for in the reports.
- Check laboratory reports to make sure hold times were met and that the reporting levels meet or are lower than the reporting levels agreed to in the contract.
- Check data for outlier values, and follow up with the laboratory if necessary.
  Occasionally typographical errors, unit reporting errors, or incomplete results are reported and should be detected easily. These errors need to be identified, clarified, and corrected quickly by the laboratory.
- Check laboratory QA/QC results.
  QA/QC checks will be performed based on acceptable criteria for laboratory analyses. The QA/QC data are reported along with the sample results. The Project Chemist will evaluate the reported QA/QC data to check for contamination (method, field, travel and/or equipment blanks), precision (laboratory matrix spike duplicates), and accuracy (matrix spikes and laboratory control samples). When QA/QC checks are outside acceptable ranges, the laboratory must flag the data, and provide an explanation of the potential impact to the sample results.
- Check the dataset for QA/QC outlier values, and request that the laboratory confirm results and re-analyze samples where appropriate.
  Sample re-analysis should only be undertaken when it appears that some part of the QA/QC resulted in a value out of the accepted range. Sample results may not be discounted unless the analytical laboratory identifies the required QA/QC criteria were not met and confirms this in writing.

Field data, including inspections and observations, must be verified as soon as the field logs are received, typically at the end of the sampling event. Field data verification will include:

- Checking field logs to make sure all required measurements and observations were completed and appropriately documented.

- Checking reported values that appear out of the typical range or inconsistent with previous results, noting data that are an order of magnitude or more different than similar locations, or are inconsistent with previous data from the same location.
- Following up immediately to identify potential reporting or equipment problems and, if appropriate, recalibrating equipment after sampling.
- Verifying equipment calibrations.
- Reviewing observations noted on the field logs.
- Reviewing notations of any errors and corrective actions taken.

7.9 RECORDS RETENTION

All records of stormwater monitoring information and copies of reports will be retained for a period of at least 3 years from date of submittal or longer if required by the RWQCB.

Results of visual monitoring, field measurements and laboratory analyses will be kept in the CERCLA SWP along with COCs, and other documentation related to the monitoring.

Records are to be kept on the Site while field activities are ongoing. Records to be retained include:

- The date, place, and time of inspections, sampling, visual observations, and/or measurements, including precipitation.
- The individual(s) who performed the inspections, sampling, visual observation, and/or field measurements.
- The date and approximate time of field measurements and sample collection for laboratory analyses.
- The individual(s) who collected the samples for laboratory analyses.
- A summary of all analytical results, the method detection limits and reporting limits, and the analytical techniques or methods used.
- QA/QC records and results.
- Field instrument calibration records.
- Visual observation and sample collection exemption records.
- The records of any corrective actions and follow-up activities that resulted from analytical results, visual observations, or inspections.

Section 8 References

California Stormwater Quality Association (CASQA), 2009. *Stormwater BMP Handbook Portal: Construction*. November. (www.casqa.org.)

Gilbane Federal. (Gilbane), 2018a. *Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12, Former Naval Station Treasure Island, San Francisco, California*. July.

Gilbane, 2018b. *Remedial Action/Non-Time Critical Removal Action Site Safety and Health Plan Installation Restoration Site 12, Former Naval Station Treasure Island, San Francisco, California.* July.

San Francisco Bay Regional Water Quality Control Board (RWQCB), 2011. *San Francisco Bay Basin (Region 2) Water Quality Control Plan (Basin Plan)*. December 31.

State Water Resources Control Board (SWRCB), 2012. *National Pollutant Discharges Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities, Order 2012-0006-DWQ, NPDES No. CAS000002.* Available on-line at: http://www.waterboards.ca.gov/water_issues/programs/stormwater/construction.shtml.

Figures

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NAVFAC Naval Facilities Engineering Command	**IR Site 12 Non-SWDA Remedial Action/ SWDA Removal Action** Former Naval Station Treasure Island San Francisco, CA	**Figure 1** Treasure Island Location Map

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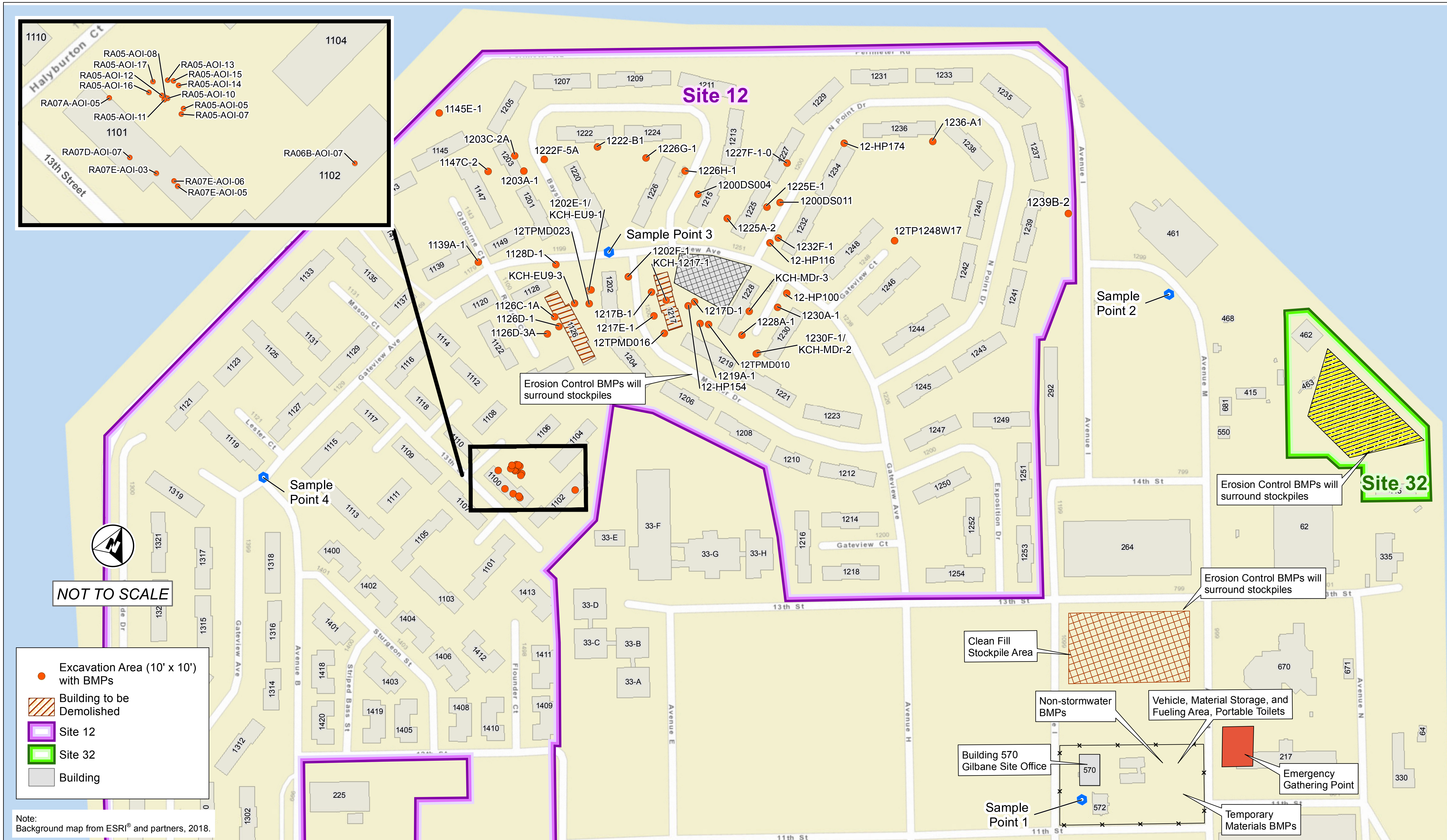

NAVFAC Naval Facilities Engineering Command

IR Site 12 Non-SWDA Remedial Action/
SWDA Removal Action
Former Naval Station Treasure Island
San Francisco, CA

Figure 2
Site Layout Map and BMPs

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G:\ArcGIS\Navy\Treasure_Island\PROJECTS\TI_Radiation_Scoping\TI_Drainage_BMPs_11x17.mxd 7/16/2018 EANDERSON, Gilbane

NAVFAC Naval Facilities Engineering Command

IR Site 12 Non-SWDA Remedial Action/
SWDA Removal Action
Former Naval Station Treasure Island
San Francisco, CA

Figure 3
Drainage Patterns and BMPs

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Appendix A: Construction Schedule

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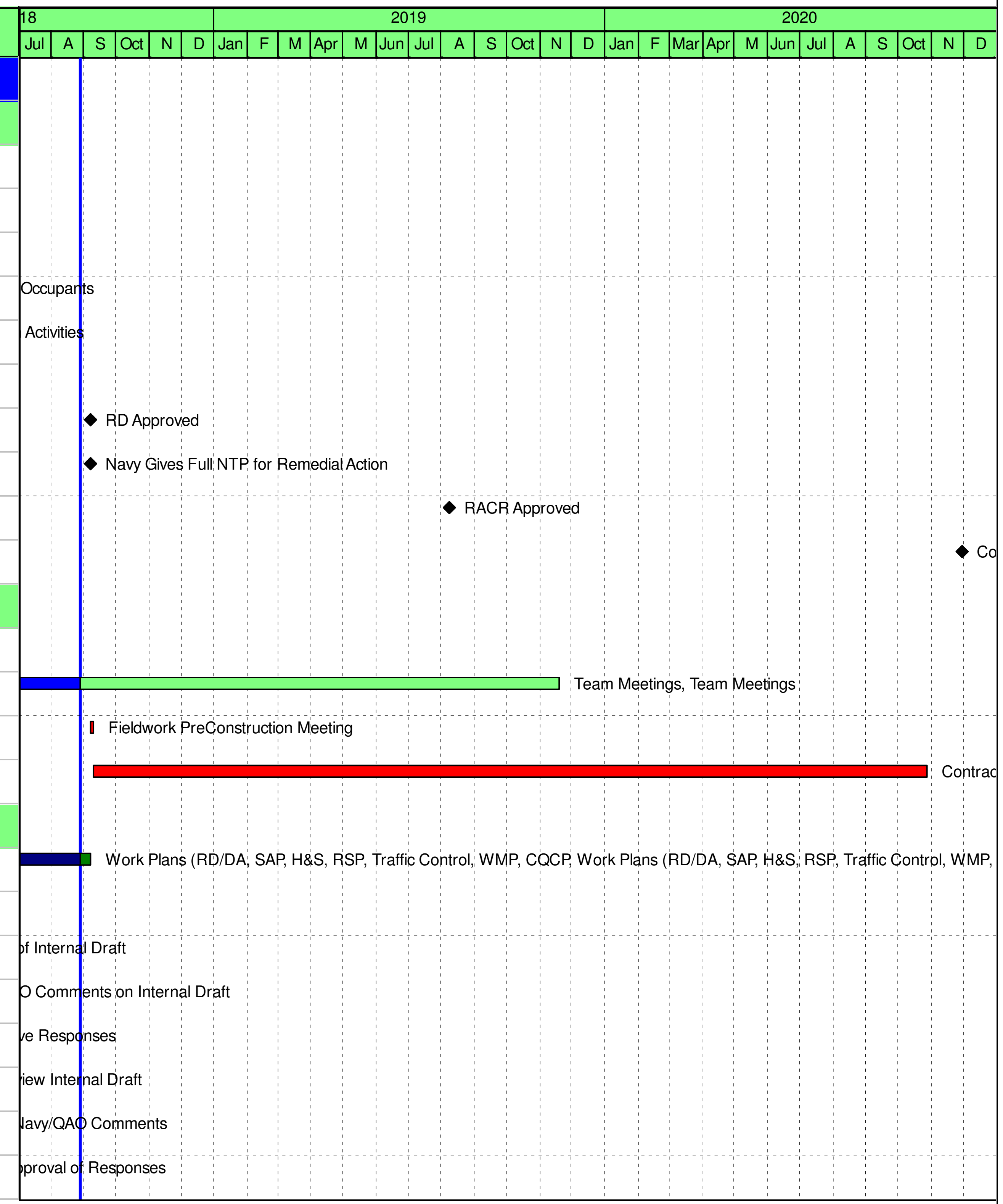
Data Date - 29-Aug-18 Run Date - 29-Aug-18

Activity ID	Activity Name	Orig Dur	Activity % Complete	Start	Finish	Predecessors
RADMAC II - Treasure Island		1155		02-Aug-17 A	30-Nov-20	
Milestones		788		02-Aug-17 A	30-Nov-20	
MS0100	Contract Award	0	100%	02-Aug-17 A		
MS0200	Submit Schedule and Agenda	0	100%	15-Aug-17 A		MS0100
MS0300	Kick-off Meeting	0	100%	15-Aug-17 A		MS0100
MS0400	Navy Gives 90-Day Notice to Bldg 1126 & 1217 Occupants	0	100%	15-Aug-17 A		MS0300
MS0500	Navy Gives Limited NTP for PreRemedial Action Activities	0	100%	15-Aug-17 A		MS0300
MS0600	Award of IDIQ Items	0	100%	22-Sep-17 A		
MS0700	RD Approved	0	0%	07-Sep-18*		PP0180
MS0800	Navy Gives Full NTP for Remedial Action	0	0%	07-Sep-18		MS0700
MS0900	RACR Approved	0	0%	09-Aug-19		RC0170
MS1000	Contractural POP Date	0	0%		30-Nov-20*	RC0170
Project Management		675		15-Aug-17 A	28-Oct-20	
PM0100	Contract Kick-off Meeting	1	100%	15-Aug-17 A	15-Aug-17 A	MS0300
PM0200	Team Meetings	534	42.7%	15-Aug-17 A	19-Nov-19	PM0100
PM0300	Fieldwork PreConstruction Meeting	1	0%	07-Sep-18*	10-Sep-18	MS0700
PM0400	Contractor QC Meetings	534	0%	10-Sep-18*	28-Oct-20	PM0300
Project Plans		896		15-Aug-17 A	07-Sep-18	
PP0100	Work Plans (RD/DA, SAP, H&S, RSP, Traffic Control, WMP, CQCP	534	98.84%	15-Aug-17 A	07-Sep-18	PP0110
PP0110	Internal Draft	35	100%	15-Aug-17 A	24-Oct-17 A	
PP0120	Navy/BRAC/RASO Review of Internal Draft	30	100%	25-Oct-17 A	18-Dec-17 A	PP0110
PP0125	Response to BRAC/RASO Comments on Internal Draft	25	100%	14-Dec-17 A	07-Jan-18 A	PP0120
PP0126	BRAC/RASO Approve Responses	30	100%	07-Jan-18 A	08-Feb-18 A	PP0125
PP0127	Navy/QAO Review Internal Draft	30	100%	09-Feb-18 A	14-Mar-18 A	PP0126
PP0128	Response to Navy/QAO Comments	5	100%	14-Mar-18 A	19-Mar-18 A	PP0127
PP0129	Navy/QAO Approval of Responses	5	100%	20-Mar-18 A	26-Mar-18 A	PP0128



Remaining Level of Effort ◆ Milestone
Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work

RADMAC II - IR 12 - Treasure Island
August 2018 Schedule

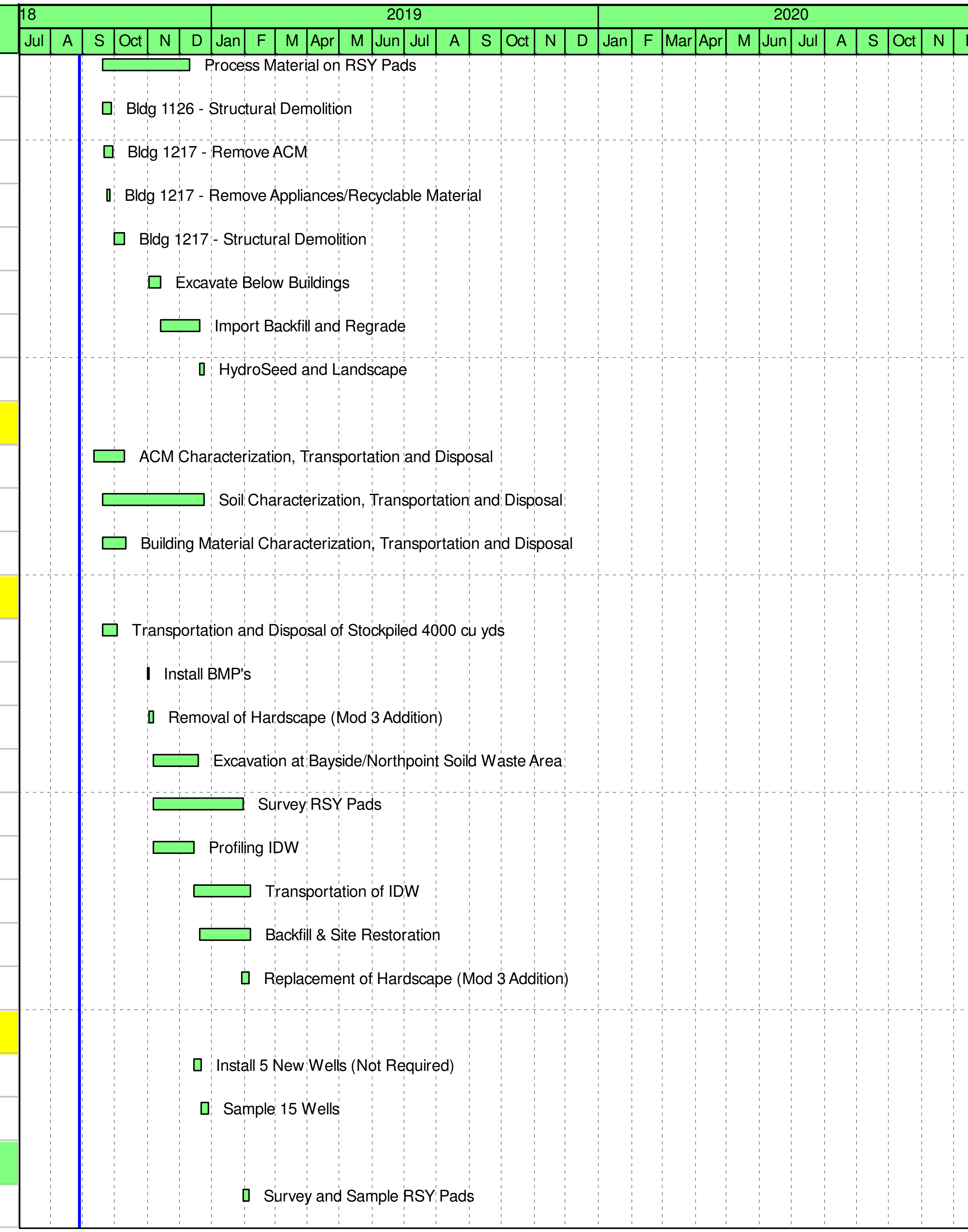
Activity ID	Activity Name	Orig Dur	Activity % Complete	Start	Finish	Predecessors
PP0130	Preparation of Draft	5	100%	27-Mar-18 A	04-Apr-18 A	PP0120, PP0129
PP0140	Navy Review of Draft (Not Required)	0	100%	05-Apr-18 A	05-Apr-18 A	PP0130
PP0150	Regulatory Review of Draft	30	100%	05-Apr-18 A	08-Jun-18 A	PP0140
PP0160	Draft Final and RTC's	21	99%	11-Jun-18 A	29-Aug-18	PP0150
PP0170	Navy Review of Draft Final	5	0%	29-Aug-18	06-Sep-18	PP0160
PP0180	Submit Final	1	0%	06-Sep-18	07-Sep-18	PP0170, PP0100
Remedial Action Implementation		107		13-Aug-18 A	06-Feb-19	
Pre-Remedial Actions		11		23-Aug-18 A	24-Sep-18	
PRE0100	Issue First Work Notice	1	0%	23-Aug-18 A	10-Sep-18	MS0700
PRE0200	Secure Buildings 1126 &1217 (Not Required)	10	0%	10-Sep-18	24-Sep-18	PRE0100
Mobilization		14		13-Aug-18 A	19-Sep-18	
MM0100	Mobilization and Set-up	12	0%	13-Aug-18 A	17-Sep-18	
MM0140	Mobilize Trailers and Equipment	4	0%	27-Aug-18 A	13-Sep-18	PRE0100
MM0110	USA Survey	3	0%	07-Sep-18	12-Sep-18	PRE0100, MM0100
MM0120	Disconnect Utilities	1	0%	07-Sep-18	10-Sep-18	PRE0100
MM0150	Establish Laydown Area and	4	0%	07-Sep-18	13-Sep-18	PRE0100
MM0130	Conduct Civil Site Survey	3	0%	10-Sep-18	13-Sep-18	PRE0100
MM0170	Install Site Security and Fences	5	0%	10-Sep-18	17-Sep-18	PRE0100
MM0160	Establish Radiological Screening (RSA's)	4	0%	13-Sep-18	19-Sep-18	MM0150
MM0180	Install BMP's and Dust Control	2	0%	13-Sep-18	17-Sep-18	MM0150, MM0100
Remedial Action		75		04-Sep-18	24-Dec-18	
RA0140	Bldg 1126 - Radiological Survey	3	0%	04-Sep-18*	06-Sep-18	MM0100
RA0180	Bldg 1217 - Radiological Survey	3	0%	04-Sep-18*	06-Sep-18	MM0100
RA0150	Bldg 1126 - Remove ACM	7	0%	11-Sep-18*	19-Sep-18	RA0140
RA0100	Conduct 40 Discreet Excavations	30	0%	19-Sep-18	01-Nov-18	MM0180, MM0160
RA0120	Backfill 40 Discreet Excavations	30	0%	19-Sep-18	01-Nov-18	RA0100
RA0130	Bldg 1126 - Remove Appliances/Recyclable Material	2	0%	19-Sep-18	21-Sep-18	RA0100

Remaining Level of Effort ◆ Milestone
Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work

RADMAC II - IR 12 - Treasure Island
August 2018 Schedule
2 of 4

Gilbane

Activity ID	Activity Name	Orig Dur	Activity % Complete	Start	Finish	Predecessors
RA0220	Process Material on RSY Pads	55	0%	19-Sep-18	11-Dec-18	RA0100
RA0160	Bldg 1126 - Structural Demolition	6	0%	20-Sep-18	27-Sep-18	RA0150
RA0190	Bldg 1217 - Remove ACM	6	0%	21-Sep-18	28-Sep-18	RA0150
RA0170	Bldg 1217 - Remove Appliances/Recyclable Material	2	0%	24-Sep-18	26-Sep-18	RA0130
RA0200	Bldg 1217 - Structural Demolition	6	0%	01-Oct-18	09-Oct-18	RA0160
RA0210	Excavate Below Buildings	6	0%	02-Nov-18	13-Nov-18	RA0100, RA0200
RA0230	Import Backfill and Regrade	25	0%	13-Nov-18	20-Dec-18	RA0210
RA0240	HydroSeed and Landscape	2	0%	20-Dec-18	24-Dec-18	RA0230
Waste Characterization, Transportation and Disposal		70		11-Sep-18	24-Dec-18	
RA0270	ACM Characterization, Transportation and Disposal	20	0%	11-Sep-18	10-Oct-18	RA0150
RA0250	Soil Characterization, Transportation and Disposal	64	0%	19-Sep-18	24-Dec-18	RA0100
RA0260	Building Material Characterization, Transportation and Disposal	15	0%	20-Sep-18	11-Oct-18	RA0160, RA0200
Continuation of NTCRA Field Activities		92		20-Sep-18	06-Feb-19	
RA0280	Transportation and Disposal of Stockpiled 4000 cu yds	10	0%	20-Sep-18	03-Oct-18	RA0160
RA0290	Install BMP's	1	0%	01-Nov-18	02-Nov-18	RA0100
RA0295	Removal of Hardscape (Mod 3 Addition)	2	0%	02-Nov-18	06-Nov-18	RA0290
RA0300	Excavation at Bayside/Northpoint Soild Waste Area	28	0%	06-Nov-18	19-Dec-18	RA0295
RA0310	Survey RSY Pads	55	0%	06-Nov-18	30-Jan-19	RA0300
RA0340	Profiling IDW	25	0%	06-Nov-18	14-Dec-18	RA0300
RA0350	Transportation of IDW	35	0%	14-Dec-18	06-Feb-19	RA0340
RA0320	Backfill & Site Restoration	31	0%	20-Dec-18	06-Feb-19	RA0300
RA0330	Replacement of Hardscape (Mod 3 Addition)	5	0%	29-Jan-19	05-Feb-19	RA0320
GW Monitoring Wells at Gateway Arsenic		9		14-Dec-18	28-Dec-18	
GW0100	Install 5 New Wells (Not Required)	5	0%	14-Dec-18	21-Dec-18	RA0350
GW0200	Sample 15 Wells	4	0%	21-Dec-18	28-Dec-18	GW0100
Demobilization and Close-out		17		30-Jan-19	25-Feb-19	
DM0100	Survey and Sample RSY Pads	4	0%	30-Jan-19	05-Feb-19	RA0310

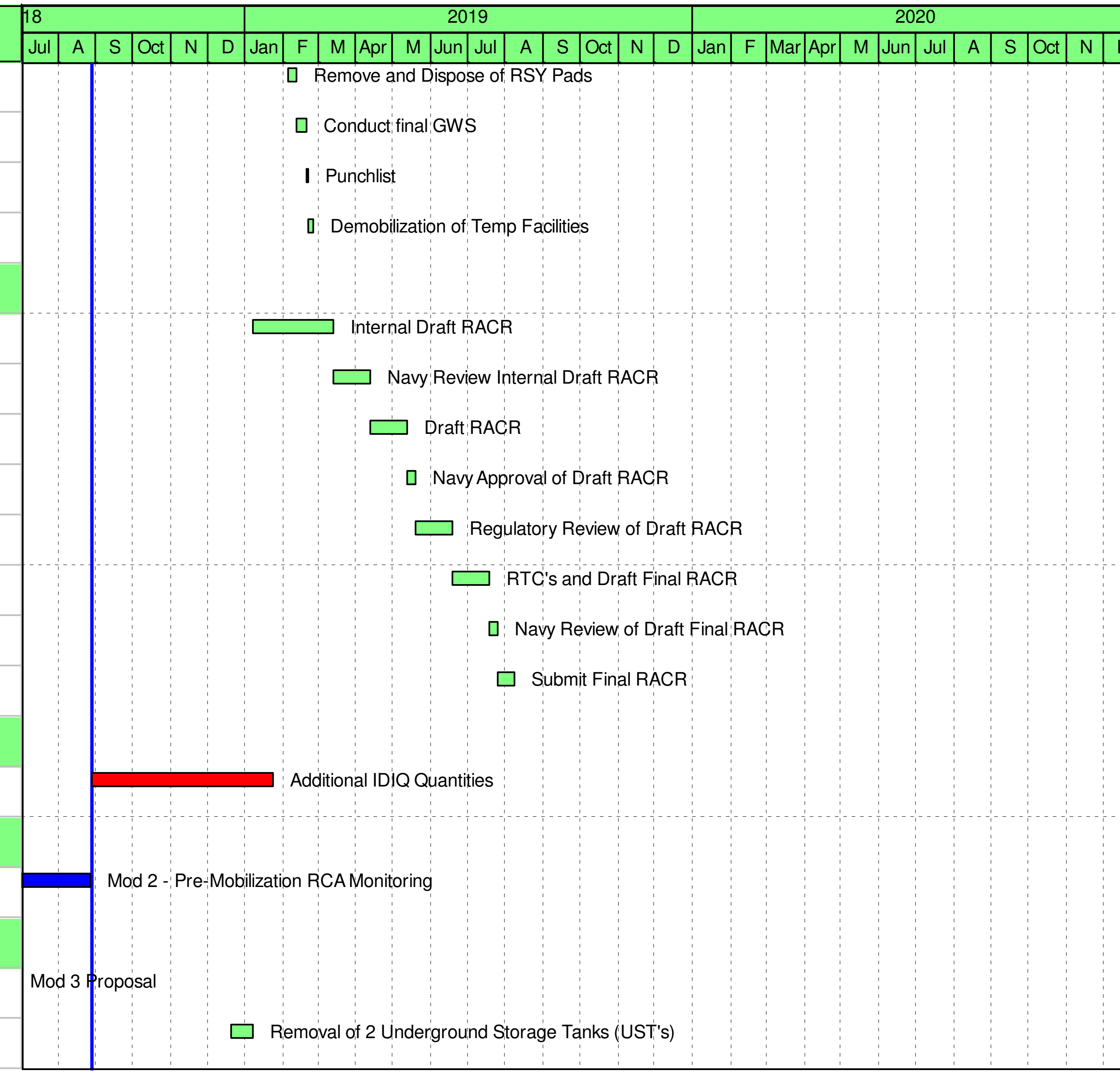


Remaining Level of Effort ◆ Milestone
Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work

RADMAC II - IR 12 - Treasure Island
August 2018 Schedule

Gilbane

Activity ID	Activity Name	Orig Dur	Activity % Complete	Start	Finish	Predecessors
DM0110	Remove and Dispose of RSY Pads	5	0%	05-Feb-19	12-Feb-19	DM0100
DM0120	Conduct final GWS	4	0%	12-Feb-19	19-Feb-19	DM0110
DM0130	Punchlist	2	0%	19-Feb-19	21-Feb-19	DM0120
DM0140	Demobilization of Temp Facilities	2	0%	21-Feb-19	25-Feb-19	DM0130
Reports and Data Submission		214		07-Jan-19	09-Aug-19	
RC0100	Internal Draft RACR	45	0%	07-Jan-19	13-Mar-19	RA0240, MOD3 100
RC0110	Navy Review Internal Draft RACR	30	0%	13-Mar-19	12-Apr-19	RC0100
RC0120	Draft RACR	21	0%	12-Apr-19	13-May-19	RC0110
RC0130	Navy Approval of Draft RACR	5	0%	13-May-19	20-May-19	RC0120
RC0140	Regulatory Review of Draft RACR	30	0%	20-May-19	19-Jun-19	RC0130
RC0150	RTC's and Draft Final RACR	21	0%	19-Jun-19	19-Jul-19	RC0140
RC0160	Navy Review of Draft Final RACR	5	0%	19-Jul-19	26-Jul-19	RC0150
RC0170	Submit Final RACR	10	0%	26-Jul-19	09-Aug-19	RC0160
MOD 1 - Additional IDIQ Quantities		98		29-Aug-18	23-Jan-19	
IDIQ0010	Additional IDIQ Quantities	98	0%	29-Aug-18*	23-Jan-19	
MOD 2 - Early Establishment of RCA Monitoring		40		19-Mar-18 A	27-Aug-18 A	
MOD2 001	Mod 2 - Pre-Mobilization RCA Monitoring	40	100%	19-Mar-18 A	27-Aug-18 A	
MOD 3 - Removal of 2 UST's		201		01-May-18 A	07-Jan-19	
MOD3 001	Mod 3 Proposal	40	100%	01-May-18 A	25-Jun-18 A	
MOD3 100	Removal of 2 Underground Storage Tanks (UST's)	10	0%	20-Dec-18	07-Jan-19	MOD3 001, RA0230



Remaining Level of Effort
Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work
◆ Milestone

RADMAC II - IR 12 - Treasure Island
August 2018 Schedule

Gilbane

Appendix B: Construction Activities, Materials Used, and Associated Pollutants

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Table B.1 Construction Activities and Associated Pollutants

Phase	Activity	Pollutant Source	Pollutant Category
General Construction, Mobilization and Site Preparation	Sanitary waste generation	▪ Portable toilets	Nutrients and bacteria
	Vehicle and equipment mobilization	▪ Equipment operation ▪ Equipment maintenance ▪ Equipment washing ▪ Equipment fueling	Oil and grease, and synthetic organics
Pre-Excavation Soil Characterization	Vegetation removal, drilling, soil sampling, filling the drilled areas	▪ Equipment operation ▪ Equipment maintenance ▪ Equipment washing ▪ Equipment fueling ▪ Soil spoils	COCs (metals, PAHs, PCBs, pesticides in soil; PAHs, and metals in groundwater); radiologically impacted soils; oil and grease, and synthetic organics
Contaminated Soil Removal	Excavation Of Contaminated Soils & Post-excavation Confirmation Sampling, Radiological Screening	▪ Equipment operation ▪ Equipment maintenance ▪ Equipment washing ▪ Equipment fueling ▪ Soil spoils	COCs (metals, PAHs, PCBs, pesticides in soil; PAHs, and metals in groundwater); radiologically impacted soils; oil and grease, and synthetic organics
Site Restoration and Demobilization	Backfilling, Waste transportation and disposal; Vehicle and equipment demobilization	▪ Equipment operation ▪ Equipment maintenance ▪ Equipment washing ▪ Equipment fueling	Oil and grease, and synthetic organics

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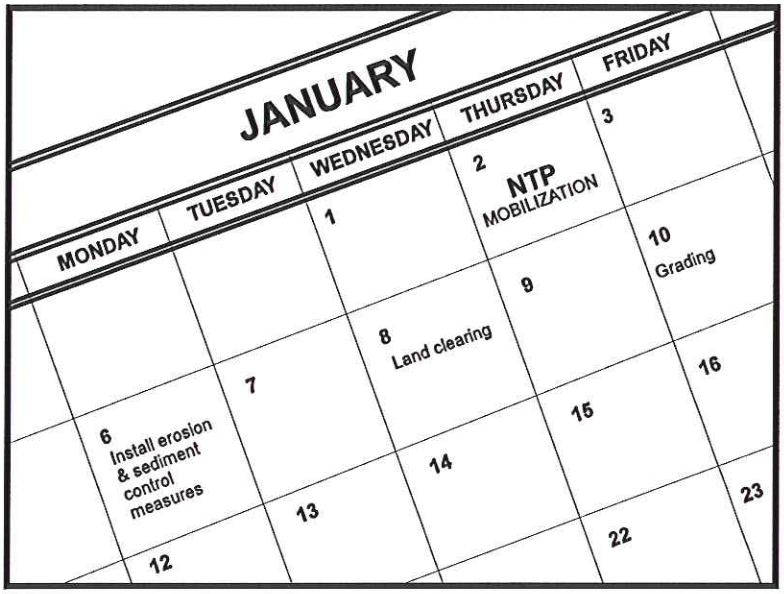
Appendix C: BMP Fact Sheets

Scheduling EC-1



Description and Purpose

Scheduling is the development of a written plan that includes sequencing of construction activities and the implementation of BMPs such as erosion control and sediment control while taking local climate (rainfall, wind, etc.) into consideration. The purpose is to reduce the amount and duration of soil exposed to erosion by wind, rain, runoff, and vehicle tracking, and to perform the construction activities and control practices in accordance with the planned schedule.

Suitable Applications

Proper sequencing of construction activities to reduce erosion potential should be incorporated into the schedule of every construction project especially during rainy season. Use of other, more costly yet less effective, erosion and sediment control BMPs may often be reduced through proper construction sequencing.

Limitations

- Environmental constraints such as nesting season prohibitions reduce the full capabilities of this BMP.

Implementation

- Avoid rainy periods. Schedule major grading operations during dry months when practical. Allow enough time before rainfall begins to stabilize the soil with vegetation or physical means or to install sediment trapping devices.

- Plan the project and develop a schedule showing each phase

Categories

EC	Erosion Control	☑
SE	Sediment Control	☒
TC	Tracking Control	☒
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

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of construction. Clearly show how the rainy season relates to soil disturbing and re-stabilization activities. Incorporate the construction schedule into the SWPPP.

- Include on the schedule, details on the rainy season implementation and deployment of:
  - Erosion control BMPs
  - Sediment control BMPs
  - Tracking control BMPs
  - Wind erosion control BMPs
  - Non-stormwater BMPs
  - Waste management and materials pollution control BMPs
- Include dates for activities that may require non-stormwater discharges such as dewatering, sawcutting, grinding, drilling, boring, crushing, blasting, painting, hydro-demolition, mortar mixing, pavement cleaning, etc.
- Work out the sequencing and timetable for the start and completion of each item such as site clearing and grubbing, grading, excavation, paving, foundation pouring utilities installation, etc., to minimize the active construction area during the rainy season.
  - Sequence trenching activities so that most open portions are closed before new trenching begins.
  - Incorporate staged seeding and re-vegetation of graded slopes as work progresses.
  - Schedule establishment of permanent vegetation during appropriate planting time for specified vegetation.
- Non-active areas should be stabilized as soon as practical after the cessation of soil disturbing activities or one day prior to the onset of precipitation.
- Monitor the weather forecast for rainfall.
- When rainfall is predicted, adjust the construction schedule to allow the implementation of soil stabilization and sediment treatment controls on all disturbed areas prior to the onset of rain.
- Be prepared year round to deploy erosion control and sediment control BMPs. Erosion may be caused during dry seasons by un-seasonal rainfall, wind, and vehicle tracking. Keep the site stabilized year round, and retain and maintain rainy season sediment trapping devices in operational condition.
- Apply permanent erosion control to areas deemed substantially complete during the project's defined seeding window.

Costs

Construction scheduling to reduce erosion may increase other construction costs due to reduced economies of scale in performing site grading. The cost effectiveness of scheduling techniques should be compared with the other less effective erosion and sedimentation controls to achieve a cost effective balance.

Inspection and Maintenance

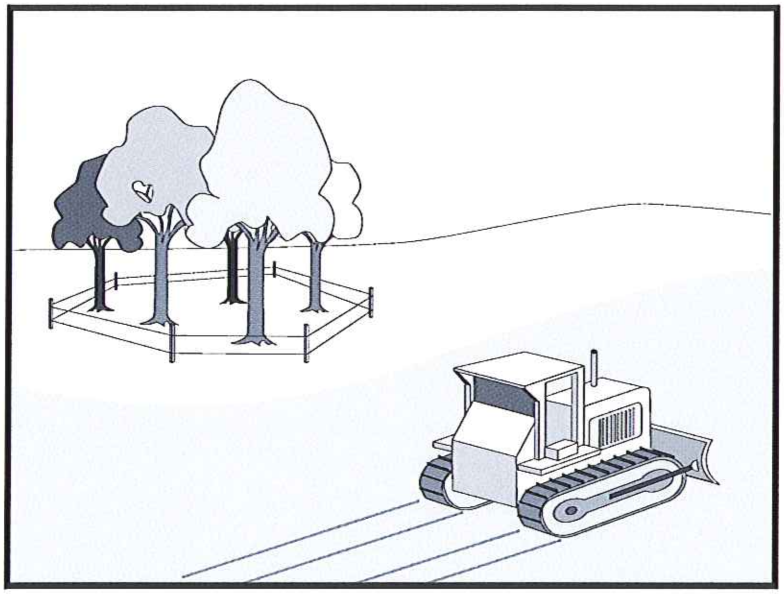
- Verify that work is progressing in accordance with the schedule. If progress deviates, take corrective actions.
- Amend the schedule when changes are warranted.
- Amend the schedule prior to the rainy season to show updated information on the deployment and implementation of construction site BMPs.

References

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities Developing Pollution Prevention Plans and Best Management Practices (EPA 832-R-92-005), U.S. Environmental Protection Agency, Office of Water, September 1992.

Preservation Of Existing Vegetation EC-2



Categories		
EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Carefully planned preservation of existing vegetation minimizes the potential of removing or injuring existing trees, vines, shrubs, and grasses that protect soil from erosion.

Suitable Applications

Preservation of existing vegetation is suitable for use on most projects. Large project sites often provide the greatest opportunity for use of this BMP. Suitable applications include the following:

- Areas within the site where no construction activity occurs, or occurs at a later date. This BMP is especially suitable to multi year projects where grading can be phased.
- Areas where natural vegetation exists and is designated for preservation. Such areas often include steep slopes, watercourse, and building sites in wooded areas.
- Areas where local, state, and federal government require preservation, such as vernal pools, wetlands, marshes, certain oak trees, etc. These areas are usually designated on the plans, or in the specifications, permits, or environmental documents.
- Where vegetation designated for ultimate removal can be temporarily preserved and be utilized for erosion control and sediment control.

Limitations

- Requires forward planning by the owner/developer,

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contractor, and design staff.

- Limited opportunities for use when project plans do not incorporate existing vegetation into the site design.

- For sites with diverse topography, it is often difficult and expensive to save existing trees while grading the site satisfactory for the planned development.

Implementation

The best way to prevent erosion is to not disturb the land. In order to reduce the impacts of new development and redevelopment, projects may be designed to avoid disturbing land in sensitive areas of the site (e.g., natural watercourses, steep slopes), and to incorporate unique or desirable existing vegetation into the site's landscaping plan. Clearly marking and leaving a buffer area around these unique areas during construction will help to preserve these areas as well as take advantage of natural erosion prevention and sediment trapping.

Existing vegetation to be preserved on the site must be protected from mechanical and other injury while the land is being developed. The purpose of protecting existing vegetation is to ensure the survival of desirable vegetation for shade, beautification, and erosion control. Mature vegetation has extensive root systems that help to hold soil in place, thus reducing erosion. In addition, vegetation helps keep soil from drying rapidly and becoming susceptible to erosion. To effectively save existing vegetation, no disturbances of any kind should be allowed within a defined area around the vegetation. For trees, no construction activity should occur within the drip line of the tree.

Timing

- Provide for preservation of existing vegetation prior to the commencement of clearing and grubbing operations or other soil disturbing activities in areas where no construction activity is planned or will occur at a later date.

Design and Layout

- Mark areas to be preserved with temporary fencing. Include sufficient setback to protect roots.

  - Orange colored plastic mesh fencing works well.

  - Use appropriate fence posts and adequate post spacing and depth to completely support the fence in an upright position.

- Locate temporary roadways, stockpiles, and layout areas to avoid stands of trees, shrubs, and grass.

- Consider the impact of grade changes to existing vegetation and the root zone.

- Maintain existing irrigation systems where feasible. Temporary irrigation may be required.

- Instruct employees and subcontractors to honor protective devices. Prohibit heavy equipment, vehicular traffic, or storage of construction materials within the protected area.

Costs

There is little cost associated with preserving existing vegetation if properly planned during the project design, and these costs may be offset by aesthetic benefits that enhance property values. During construction, the cost for preserving existing vegetation will likely be less than the cost of applying erosion and sediment controls to the disturbed area. Replacing vegetation inadvertently destroyed during construction can be extremely expensive, sometimes in excess of $10,000 per tree.

Inspection and Maintenance

During construction, the limits of disturbance should remain clearly marked at all times. Irrigation or maintenance of existing vegetation should be described in the landscaping plan. If damage to protected trees still occurs, maintenance guidelines described below should be followed:

- Verify that protective measures remain in place. Restore damaged protection measures immediately.
- Serious tree injuries shall be attended to by an arborist.
- Damage to the crown, trunk, or root system of a retained tree shall be repaired immediately.
- Trench as far from tree trunks as possible, usually outside of the tree drip line or canopy. Curve trenches around trees to avoid large roots or root concentrations. If roots are encountered, consider tunneling under them. When trenching or tunneling near or under trees to be retained, place tunnels at least 18 in. below the ground surface, and not below the tree center to minimize impact on the roots.
- Do not leave tree roots exposed to air. Cover exposed roots with soil as soon as possible. If soil covering is not practical, protect exposed roots with wet burlap or peat moss until the tunnel or trench is ready for backfill.
- Cleanly remove the ends of damaged roots with a smooth cut.
- Fill trenches and tunnels as soon as possible. Careful filling and tamping will eliminate air spaces in the soil, which can damage roots.
- If bark damage occurs, cut back all loosened bark into the undamaged area, with the cut tapered at the top and bottom and drainage provided at the base of the wood. Limit cutting the undamaged area as much as possible.
- Aerate soil that has been compacted over a trees root zone by punching holes 12 in. deep with an iron bar, and moving the bar back and forth until the soil is loosened. Place holes 18 in. apart throughout the area of compacted soil under the tree crown.
- Fertilization
  - Fertilize stressed or damaged broadleaf trees to aid recovery.
  - Fertilize trees in the late fall or early spring.

- Apply fertilizer to the soil over the feeder roots and in accordance with label instructions, but never closer than 3 ft to the trunk. Increase the fertilized area by one-fourth of the crown area for conifers that have extended root systems.

- Retain protective measures until all other construction activity is complete to avoid damage during site cleanup and stabilization.

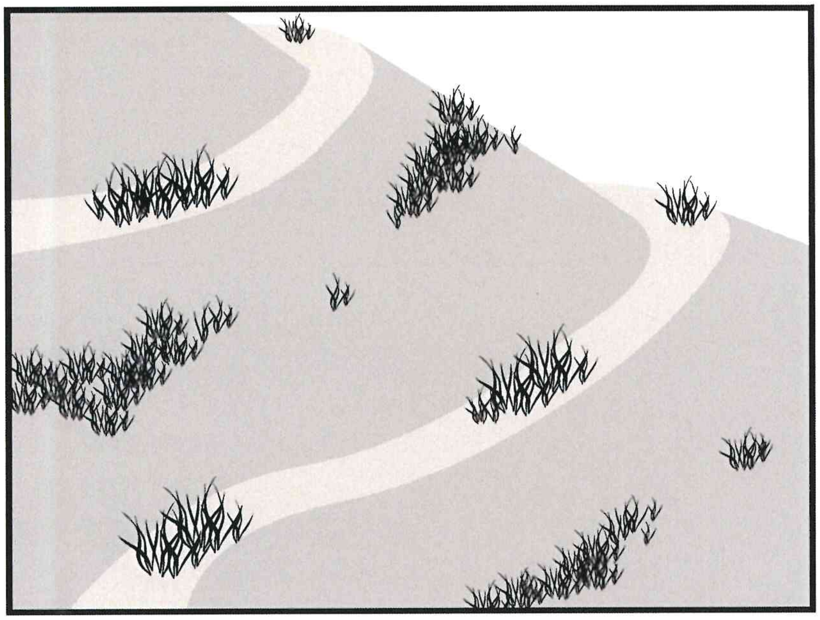
References

County of Sacramento Tree Preservation Ordinance, September 1981.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for The Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch

EC-5 Soil Binders

EC-6 Straw Mulch

EC-7 Geotextiles and Mats

EC-8 Wood Mulching

EC-14 Compost Blanket

EC-16 Non-Vegetative Stabilization

Description and Purpose

Hydroseeding typically consists of applying a mixture of a hydraulic mulch, seed, fertilizer, and stabilizing emulsion with a hydraulic mulcher, to temporarily protect exposed soils from erosion by water and wind. Hydraulic seeding, or hydroseeding, is simply the method by which temporary or permanent seed is applied to the soil surface.

Suitable Applications

Hydroseeding is suitable for disturbed areas requiring temporary protection until permanent stabilization is established, for disturbed areas that will be re-disturbed following an extended period of inactivity, or to apply permanent stabilization measures. Hydroseeding without mulch or other cover (e.g. EC-7, Erosion Control Blanket) is not a stand-alone erosion control BMP and should be combined with additional measures until vegetation establishment.

Typical applications for hydroseeding include:

- Disturbed soil/graded areas where permanent stabilization or continued earthwork is not anticipated prior to seed germination.
- Cleared and graded areas exposed to seasonal rains or temporary irrigation.
- Areas not subject to heavy wear by construction equipment or high traffic.

Limitations

- Availability of hydroseeding equipment may be limited just prior to the rainy season and prior to storms due to high demand.
- Hydraulic seed should be applied with hydraulic mulch or a stand-alone hydroseed application should be followed by one of the following:
    - Straw mulch (see Straw Mulch EC-6)
    - Rolled erosion control products (see Geotextiles and Mats EC-7)
    - Application of Compost Blanket (see Compost Blanket EC-14)

  Hydraulic seed may be used alone only on small flat surfaces when there is sufficient time in the season to ensure adequate vegetation establishment and coverage to provide adequate erosion control.
- Hydraulic seed without mulch does not provide immediate erosion control.
- Temporary seeding may not be appropriate for steep slopes (i.e., slopes readily prone to rill erosion or without sufficient topsoil).
- Temporary seeding may not be appropriate in dry periods without supplemental irrigation.
- Temporary vegetation may have to be removed before permanent vegetation is applied.
- Temporary vegetation may not be appropriate for short term inactivity (i.e. less than 3-6 months).

Implementation

In order to select appropriate hydraulic seed mixtures, an evaluation of site conditions should be performed with respect to:

- Soil conditions
- Site topography and exposure (sun/wind)
- Season and climate
- Vegetation types
- Maintenance requirements
- Sensitive adjacent areas
- Water availability
- Plans for permanent vegetation

The local office of the U.S.D.A. Natural Resources Conservation Service (NRCS) is an excellent source of information on appropriate seed mixes.

The following steps should be followed for implementation:

- Where appropriate or feasible, soil should be prepared to receive the seed by disking or otherwise scarifying (See EC-15, Soil Preparation) the surface to eliminate crust, improve air and water infiltration and create a more favorable environment for germination and growth.

- Avoid use of hydraulic seed in areas where the BMP would be incompatible with future earthwork activities.
- Hydraulic seed can be applied using a multiple step or one step process.
  - In a multiple step process, hydraulic seed is applied first, followed by mulch or a Rolled Erosion Control Product (RECP).
  - In the one step process, hydraulic seed is applied with hydraulic mulch in a hydraulic matrix. When the one step process is used to apply the mixture of fiber, seed, etc., the seed rate should be increased to compensate for all seeds not having direct contact with the soil.
- All hydraulically seeded areas should have mulch, or alternate erosion control cover to keep seeds in place and to moderate soil moisture and temperature until the seeds germinate and grow.
- All seeds should be in conformance with the California State Seed Law of the Department of Agriculture. Each seed bag should be delivered to the site sealed and clearly marked as to species, purity, percent germination, dealer's guarantee, and dates of test. The container should be labeled to clearly reflect the amount of Pure Live Seed (PLS) contained. All legume seed should be pellet inoculated. Inoculant sources should be species specific and should be applied at a rate of 2 lb of inoculant per 100 lb seed.
- Commercial fertilizer should conform to the requirements of the California Food and Agricultural Code, which can be found at http://www.leginfo.ca.gov/.html/fac_table_of_contents.html. Fertilizer should be pelleted or granular form.
- Follow up applications should be made as needed to cover areas of poor coverage or germination/vegetation establishment and to maintain adequate soil protection.
- Avoid over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.
- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

Costs

Average cost for installation and maintenance may vary from as low as $1,900 per acre for flat slopes and stable soils, to $4,000 per acre for moderate to steep slopes and/or erosive soils. Cost of seed mixtures vary based on types of required vegetation.

BMP	Installed Cost per Acre
Hydraulic Seed	$1,900-$4,000

Source: Caltrans Soil Stabilization BMP Research for Erosion and Sediment Controls, July 2007

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Areas where erosion is evident should be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.

- Where seeds fail to germinate, or they germinate and die, the area must be re-seeded, fertilized, and mulched within the planting season, using not less than half the original application rates.

- Irrigation systems, if applicable, should be inspected daily while in use to identify system malfunctions and line breaks. When line breaks are detected, the system must be shut down immediately and breaks repaired before the system is put back into operation.

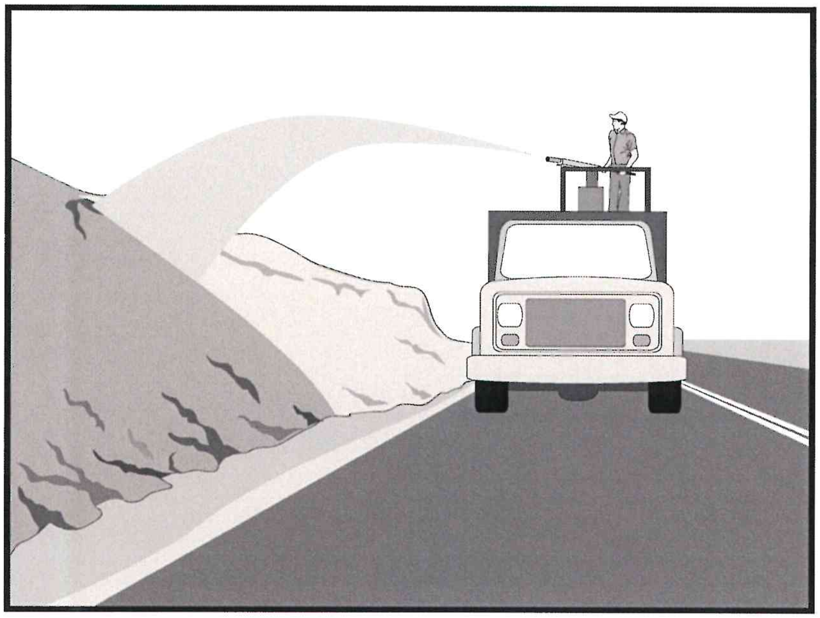
- Irrigation systems should be inspected for complete coverage and adjusted as needed to maintain complete coverage.

References

Soil Stabilization BMP Research for Erosion and Sediment Controls: Cost Survey Technical Memorandum, State of California Department of Transportation (Caltrans), July 2007.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999.



Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch

EC-4 Hydroseeding

EC-5 Soil Binders

EC-7 Geotextiles and Mats

EC-8 Wood Mulching

EC-14 Compost Blanket

Description and Purpose

Straw mulch consists of placing a uniform layer of straw and incorporating it into the soil with a studded roller or crimper, or anchoring it with a tackifier or stabilizing emulsion. Straw mulch protects the soil surface from the impact of rain drops, preventing soil particles from becoming dislodged.

Suitable Applications

Straw mulch is suitable for disturbed areas requiring temporary protection until permanent stabilization is established. Straw mulch can be specified for the following applications:

- As a stand-alone BMP on disturbed areas until soils can be prepared for permanent vegetation. The longevity of straw mulch is typically less than six months.
- Applied in combination with temporary seeding strategies
- Applied in combination with permanent seeding strategies to enhance plant establishment and final soil stabilization
- Applied around containerized plantings to control erosion until the plants become established to provide permanent stabilization

Limitations

- Availability of straw and straw blowing equipment may be limited just prior to the rainy season and prior to storms due to high demand.

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- There is a potential for introduction of weed seed and unwanted plant material if weed-free agricultural straw is not specified.
- Straw mulch applied by hand is more time intensive and potentially costly.
- Wind may limit application of straw and blow straw into undesired locations.
- May have to be removed prior to permanent seeding or prior to further earthwork.
- "Punching" of straw does not work in sandy soils, necessitating the use of tackifiers.
- Potential fugitive dust control issues associated with straw applications can occur. Application of a stabilizing emulsion or a water stream at the same time straw is being blown can reduce this problem.
- Use of plastic netting should be avoided in areas where wildlife may be entrapped and may be prohibited for projects in certain areas with sensitive wildlife species, especially reptiles and amphibians.

Implementation

- Straw should be derived from weed-free wheat, rice, or barley. Where required by the plans, specifications, permits, or environmental documents, native grass straw should be used.
- Use tackifier to anchor straw mulch to the soil on slopes.
- Crimping, punch roller-type rollers, or track walking may also be used to incorporate straw mulch into the soil on slopes. Track walking can be used where other methods are impractical.
- Avoid placing straw onto roads, sidewalks, drainage channels, sound walls, existing vegetation, etc.
- Straw mulch with tackifier should not be applied during or immediately before rainfall.
- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

Application Procedures

- When using a tackifier to anchor the straw mulch, roughen embankment or fill areas by rolling with a crimping or punching-type roller or by track walking before placing the straw mulch. Track walking should only be used where rolling is impractical.
- Apply straw at a rate of between 3,000 and 4,000 lb/acre, either by machine or by hand distribution and provide 100% ground cover. A lighter application is used for flat surfaces and a heavier application is used for slopes.
- Evenly distribute straw mulch on the soil surface.
- Anchoring straw mulch to the soil surface by "punching" it into the soil mechanically (incorporating) can be used in lieu of a tackifier.

- Methods for holding the straw mulch in place depend upon the slope steepness, accessibility, soil conditions, and longevity.
  - A tackifier acts to glue the straw fibers together and to the soil surface. The tackifier should be selected based on longevity and ability to hold the fibers in place. A tackifier is typically applied at a rate of 125 lb/acre. In windy conditions, the rates are typically 180 lb/acre.
  - On very small areas, a spade or shovel can be used to punch in straw mulch.
  - On slopes with soils that are stable enough and of sufficient gradient to safely support construction equipment without contributing to compaction and instability problems, straw can be "punched" into the ground using a knife blade roller or a straight bladed coulter, known commercially as a "crimper."

Costs

Average annual cost for installation and maintenance is included in the table below. Application by hand is more time intensive and potentially more costly.

BMP	Unit Cost per Acre
Straw mulch, crimped or punched	\$2,458-\$5,375
Straw mulch with tackifier	\$1,823-\$4,802

Source: Caltrans Soil Stabilization BMP Research for Erosion and Sediment Controls, July 2007

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Areas where erosion is evident should be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- The key consideration in inspection and maintenance is that the straw needs to last long enough to achieve erosion control objectives. Straw mulch as a stand-alone BMP is temporary and is not suited for long-term erosion control.
- Maintain an unbroken, temporary mulched ground cover while disturbed soil areas are inactive. Repair any damaged ground cover and re-mulch exposed areas.
- Reapplication of straw mulch and tackifier may be required to maintain effective soil stabilization over disturbed areas and slopes.

References

Soil Stabilization BMP Research for Erosion and Sediment Controls: Cost Survey Technical Memorandum, State of California Department of Transportation (Caltrans), July 2007.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Controlling Erosion of Construction Sites, Agricultural Information Bulletin #347, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service – SCS).

Guides for Erosion and Sediment Control in California, USDA Soils Conservation Service, January 1991.

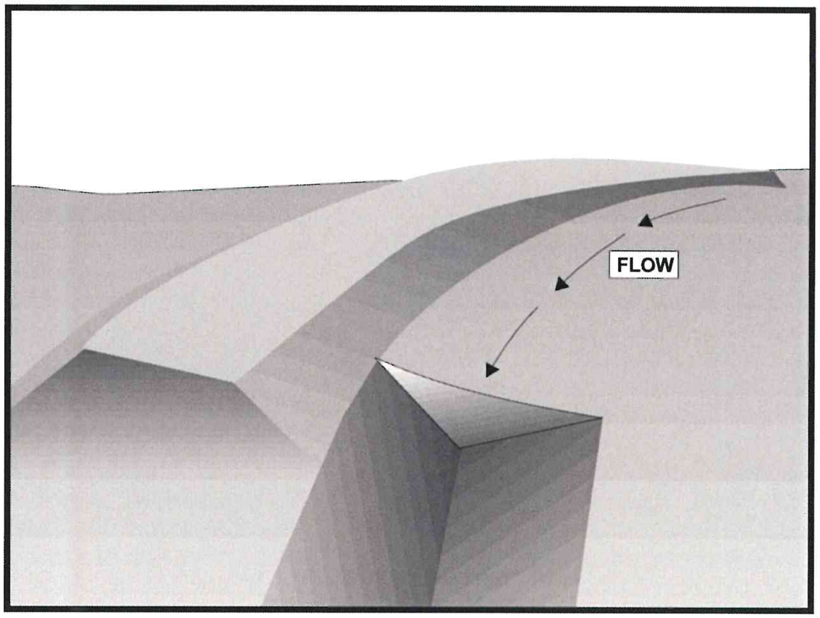
Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Soil Erosion by Water, Agricultural Information Bulletin #513, U.S. Department of Agriculture, Soil Conservation Service.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



Categories

EC	Erosion Control	☑
SE	Sediment Control	
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WE	Wind Erosion Control	
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WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

An earth dike is a temporary berm or ridge of compacted soil used to divert runoff or channel water to a desired location. A drainage swale is a shaped and sloped depression in the soil surface used to convey runoff to a desired location. Earth dikes and drainage swales are used to divert off site runoff around the construction site, divert runoff from stabilized areas and disturbed areas, and direct runoff into sediment basins or traps.

Suitable Applications

Earth dikes and drainage swales are suitable for use, individually or together, where runoff needs to be diverted from one area and conveyed to another.

- Earth dikes and drainage swales may be used:
  - To convey surface runoff down sloping land
  - To intercept and divert runoff to avoid sheet flow over sloped surfaces
  - To divert and direct runoff towards a stabilized watercourse, drainage pipe or channel
  - To intercept runoff from paved surfaces
  - Below steep grades where runoff begins to concentrate
  - Along roadways and facility improvements subject to flood drainage

- At the top of slopes to divert runon from adjacent or undisturbed slopes

- At bottom and mid slope locations to intercept sheet flow and convey concentrated flows

- Divert sediment laden runoff into sediment basins or traps

Limitations

Dikes should not be used for drainage areas greater than 10 acres or along slopes greater than 10 percent. For larger areas more permanent drainage structures should be built. All drainage structures should be built in compliance with local municipal requirements.

- Earth dikes may create more disturbed area on site and become barriers to construction equipment.
- Earth dikes must be stabilized immediately, which adds cost and maintenance concerns.
- Diverted stormwater may cause downstream flood damage.
- Dikes should not be constructed of soils that may be easily eroded.
- Regrading the site to remove the dike may add additional cost.
- Temporary drains and swales or any other diversion of runoff should not adversely impact upstream or downstream properties.
- Temporary drains and swales must conform to local floodplain management requirements.
- Earth dikes/drainage swales are not suitable as sediment trapping devices.
- It may be necessary to use other soil stabilization and sediment controls such as check dams, plastics, and blankets, to prevent scour and erosion in newly graded dikes, swales, and ditches.
- Sediment accumulation, scour depressions, and/or persistent non-stormwater discharges can result in areas of standing water suitable for mosquito production in drainage swales.

Implementation

The temporary earth dike is a berm or ridge of compacted soil, located in such a manner as to divert stormwater to a sediment trapping device or a stabilized outlet, thereby reducing the potential for erosion and offsite sedimentation. Earth dikes can also be used to divert runoff from off site and from undisturbed areas away from disturbed areas and to divert sheet flows away from unprotected slopes.

An earth dike does not itself control erosion or remove sediment from runoff. A dike prevents erosion by directing runoff to an erosion control device such as a sediment trap or directing runoff away from an erodible area. Temporary diversion dikes should not adversely impact adjacent properties and must conform to local floodplain management regulations, and should not be used in areas with slopes steeper than 10%.

Slopes that are formed during cut and fill operations should be protected from erosion by runoff. A combination of a temporary drainage swale and an earth dike at the top of a slope can divert runoff to a location where it can be brought to the bottom of the slope (see EC-11, Slope Drains). A combination dike and swale is easily constructed by a single pass of a bulldozer or grader and compacted by a second pass of the tracks or wheels over the ridge. Diversion structures should be installed when the site is initially graded and remain in place until post construction BMPs are installed and the slopes are stabilized.

Diversion practices concentrate surface runoff, increasing its velocity and erosive force. Thus, the flow out of the drain or swale must be directed onto a stabilized area or into a grade stabilization structure. If significant erosion will occur, a swale should be stabilized using vegetation, chemical treatment, rock rip-rap, matting, or other physical means of stabilization. Any drain or swale that conveys sediment laden runoff must be diverted into a sediment basin or trap before it is discharged from the site.

General

- Care must be applied to correctly size and locate earth dikes, drainage swales. Excessively steep, unlined dikes, and swales are subject to erosion and gully formation.
- Conveyances should be stabilized.
- Use a lined ditch for high flow velocities.
- Select flow velocity based on careful evaluation of the risks due to erosion of the measure, soil types, overtopping, flow backups, washout, and drainage flow patterns for each project site.
- Compact any fills to prevent unequal settlement.
- Do not divert runoff onto other property without securing written authorization from the property owner.
- When possible, install and utilize permanent dikes, swales, and ditches early in the construction process.
- Provide stabilized outlets.

Earth Dikes

Temporary earth dikes are a practical, inexpensive BMP used to divert stormwater runoff. Temporary diversion dikes should be installed in the following manner:

- All dikes should be compacted by earth moving equipment.
- All dikes should have positive drainage to an outlet.
- All dikes should have 2:1 or flatter side slopes, 18 in. minimum height, and a minimum top width of 24 in. Wide top widths and flat slopes are usually needed at crossings for construction traffic.
- The outlet from the earth dike must function with a minimum of erosion. Runoff should be conveyed to a sediment trapping device such as a Sediment Trap (SE-3) or Sediment Basin

(SE-2) when either the dike channel or the drainage area above the dike are not adequately stabilized.

- Temporary stabilization may be achieved using seed and mulching for slopes less than 5% and either rip-rap or sod for slopes in excess of 5%. In either case, stabilization of the earth dike should be completed immediately after construction or prior to the first rain.
- If riprap is used to stabilize the channel formed along the toe of the dike, the following typical specifications apply:

Channel Grade	Riprap Stabilization
0.5-1.0%	4 in. Rock
1.1-2.0%	6 in. Rock
2.1-4.0%	8 in. Rock
4.1-5.0%	8 in. -12 in. Riprap

- The stone riprap, recycled concrete, etc. used for stabilization should be pressed into the soil with construction equipment.
- Filter cloth may be used to cover dikes in use for long periods.
- Construction activity on the earth dike should be kept to a minimum.

Drainage Swales

Drainage swales are only effective if they are properly installed. Swales are more effective than dikes because they tend to be more stable. The combination of a swale with a dike on the downhill side is the most cost effective diversion.

Standard engineering design criteria for small open channel and closed conveyance systems should be used (see the local drainage design manual). Unless local drainage design criteria state otherwise, drainage swales should be designed as follows:

- No more than 5 acres may drain to a temporary drainage swale.
- Place drainage swales above or below, not on, a cut or fill slope.
- Swale bottom width should be at least 2 ft
- Depth of the swale should be at least 18 in.
- Side slopes should be 2:1 or flatter.
- Drainage or swales should be laid at a grade of at least 1 percent, but not more than 15 percent.
- The swale must not be overtopped by the peak discharge from a 10-year storm, irrespective of the design criteria stated above.

- Remove all trees, stumps, obstructions, and other objectionable material from the swale when it is built.

- Compact any fill material along the path of the swale.

- Stabilize all swales immediately. Seed and mulch swales at a slope of less than 5 percent, and use rip-rap or sod for swales with a slope between 5 and 15 percent. For temporary swales, geotextiles and mats (EC-7) may provide immediate stabilization.

- Irrigation may be required to establish sufficient vegetation to prevent erosion.

- Do not operate construction vehicles across a swale unless a stabilized crossing is provided.

- Permanent drainage facilities must be designed by a professional engineer (see the local drainage design criteria for proper design).

- At a minimum, the drainage swale should conform to predevelopment drainage patterns and capacities.

- Construct the drainage swale with a positive grade to a stabilized outlet.

- Provide erosion protection or energy dissipation measures if the flow out of the drainage swale can reach an erosive velocity.

Costs

- Cost ranges from $15 to $55 per ft for both earthwork and stabilization and depends on availability of material, site location, and access.

- Small dikes: $2.50 - $6.50/linear ft; Large dikes: $2.50/yd^3.

- The cost of a drainage swale increases with drainage area and slope. Typical swales for controlling internal erosion are inexpensive, as they are quickly formed during routine earthwork.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.

- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.

- Inspect ditches and berms for washouts. Replace lost riprap, damaged linings or soil stabilizers as needed.

- Inspect channel linings, embankments, and beds of ditches and berms for erosion and accumulation of debris and sediment. Remove debris and sediment and repair linings and embankments as needed.

- Temporary conveyances should be completely removed as soon as the surrounding drainage area has been stabilized or at the completion of construction

References

Erosion and Sediment Control Handbook, S.J. Goldman, K. Jackson, T.A. Bursetynsky, P.E., McGraw Hill Book Company, 1986.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Metzger, M.E. 2004. Managing mosquitoes in stormwater treatment devices. University of California Division of Agriculture and Natural Resources, Publication 8125. On-line: http://anrcatalog.ucdavis.edu/pdf/8125.pdf

National Association of Home Builders (NAHB). Stormwater Runoff & Nonpoint Source Pollution Control Guide for Builders and Developers. National Association of Home Builders, Washington, D.C., 1995

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

Southeastern Wisconsin Regional Planning Commission (SWRPC). Costs of Urban Nonpoint Source Water Pollution Control Measures. Technical Report No. 31. Southeastern Wisconsin Regional Planning Commission, Waukesha, WI. 1991

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

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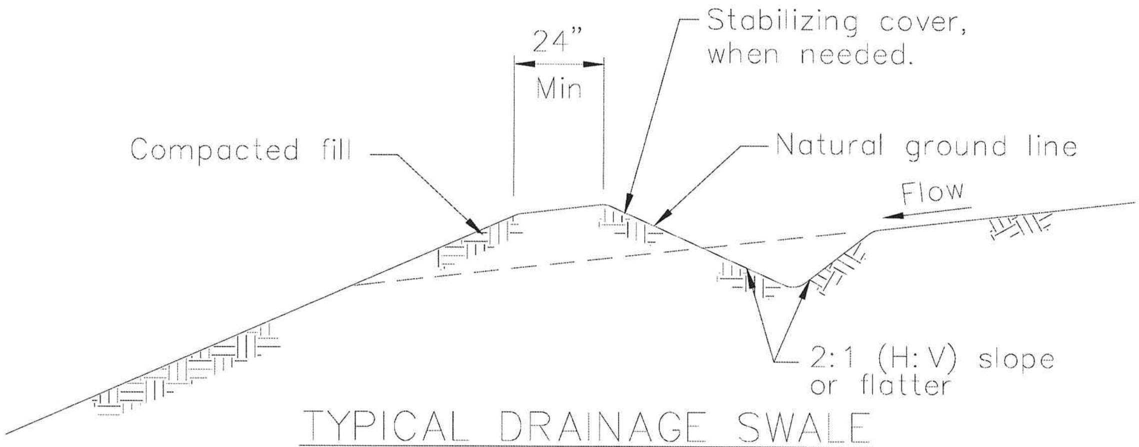
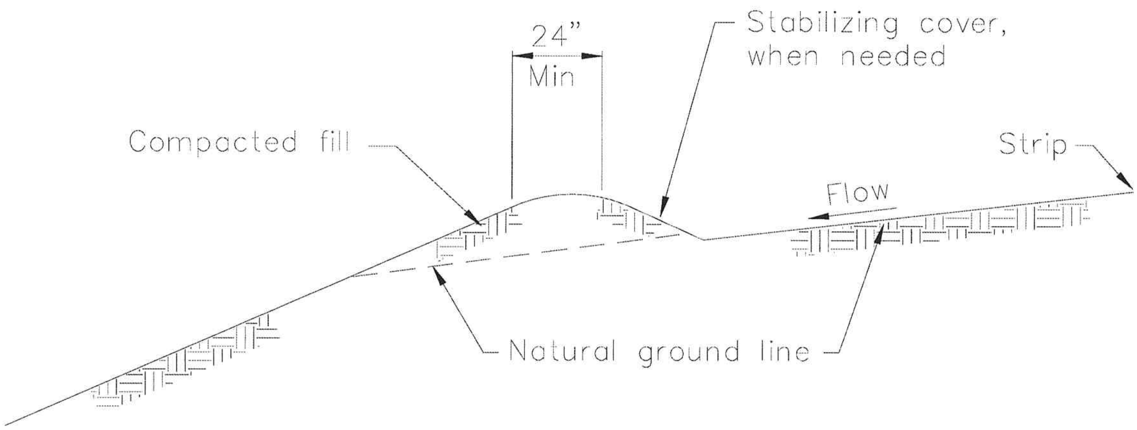


TYPICAL DRAINAGE SWALE

NOT TO SCALE

NOTES:

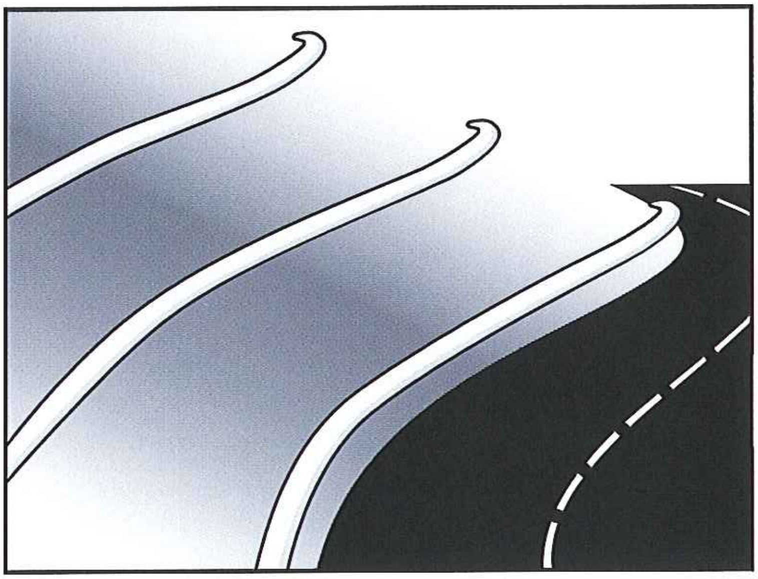
1. Stabilize inlet, outlets and slopes.
2. Properly compact the subgrade.



TYPICAL EARTH DIKE

NOT TO SCALE

Fiber Rolls SE-5



Categories

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Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-14 Biofilter Bags

Description and Purpose

A fiber roll consists of straw, coir, or other biodegradable materials bound into a tight tubular roll wrapped by netting, which can be photodegradable or natural. Additionally, gravel core fiber rolls are available, which contain an imbedded ballast material such as gravel or sand for additional weight when staking the rolls are not feasible (such as use as inlet protection). When fiber rolls are placed at the toe and on the face of slopes along the contours, they intercept runoff, reduce its flow velocity, release the runoff as sheet flow, and provide removal of sediment from the runoff (through sedimentation). By interrupting the length of a slope, fiber rolls can also reduce sheet and rill erosion until vegetation is established.

Suitable Applications

Fiber rolls may be suitable:

- Along the toe, top, face, and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.
- At the end of a downward slope where it transitions to a steeper slope.
- Along the perimeter of a project.
- As check dams in unlined ditches with minimal grade.
- Down-slope of exposed soil areas.
- At operational storm drains as a form of inlet protection.

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- Around temporary stockpiles.

Limitations

- Fiber rolls are not effective unless trenched in and staked.
- Not intended for use in high flow situations.
- Difficult to move once saturated.
- If not properly staked and trenched in, fiber rolls could be transported by high flows.
- Fiber rolls have a very limited sediment capture zone.
- Fiber rolls should not be used on slopes subject to creep, slumping, or landslide.
- Rolls typically function for 12-24 months depending upon local conditions.

Implementation

Fiber Roll Materials

- Fiber rolls should be prefabricated.
- Fiber rolls may come manufactured containing polyacrylamide (PAM), a flocculating agent within the roll. Fiber rolls impregnated with PAM provide additional sediment removal capabilities and should be used in areas with fine, clayey or silty soils to provide additional sediment removal capabilities. Monitoring may be required for these installations.
- Fiber rolls are made from weed free rice straw, flax, or a similar agricultural material bound into a tight tubular roll by netting.
- Typical fiber rolls vary in diameter from 9 in. to 20 in. Larger diameter rolls are available as well.

Installation

- Locate fiber rolls on level contours spaced as follows:
  - Slope inclination of 4:1 (H:V) or flatter: Fiber rolls should be placed at a maximum interval of 20 ft.
  - Slope inclination between 4:1 and 2:1 (H:V): Fiber Rolls should be placed at a maximum interval of 15 ft. (a closer spacing is more effective).
  - Slope inclination 2:1 (H:V) or greater: Fiber Rolls should be placed at a maximum interval of 10 ft. (a closer spacing is more effective).
- Prepare the slope before beginning installation.
- Dig small trenches across the slope on the contour. The trench depth should be ¼ to 1/3 of the thickness of the roll, and the width should equal the roll diameter, in order to provide area to backfill the trench.

- It is critical that rolls are installed perpendicular to water movement, and parallel to the slope contour.
- Start building trenches and installing rolls from the bottom of the slope and work up.
- It is recommended that pilot holes be driven through the fiber roll. Use a straight bar to drive holes through the roll and into the soil for the wooden stakes.
- Turn the ends of the fiber roll up slope to prevent runoff from going around the roll.
- Stake fiber rolls into the trench.
  - Drive stakes at the end of each fiber roll and spaced 4 ft maximum on center.
  - Use wood stakes with a nominal classification of 0.75 by 0.75 in. and minimum length of 24 in.
- If more than one fiber roll is placed in a row, the rolls should be overlapped, not abutted.
- See typical fiber roll installation details at the end of this fact sheet.

Removal

- Fiber rolls can be left in place or removed depending on the type of fiber roll and application (temporary vs. permanent installation). Typically, fiber rolls encased with plastic netting are used for a temporary application because the netting does not biodegrade. Fiber rolls used in a permanent application are typically encased with a biodegradeable material and are left in place. Removal of a fiber roll used in a permanent application can result in greater disturbance.
- Temporary installations should only be removed when up gradient areas are stabilized per General Permit requirements, and/or pollutant sources no longer present a hazard. But, they should also be removed before vegetation becomes too mature so that the removal process does not disturb more soil and vegetation than is necessary.

Costs

Material costs for regular fiber rolls range from $20 - $30 per 25 ft roll.

Material costs for PAM impregnated fiber rolls range between 7.00-$9.00 per linear foot, based upon vendor research.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Repair or replace split, torn, unraveling, or slumping fiber rolls.
- If the fiber roll is used as a sediment capture device, or as an erosion control device to maintain sheet flows, sediment that accumulates in the BMP should be periodically removed

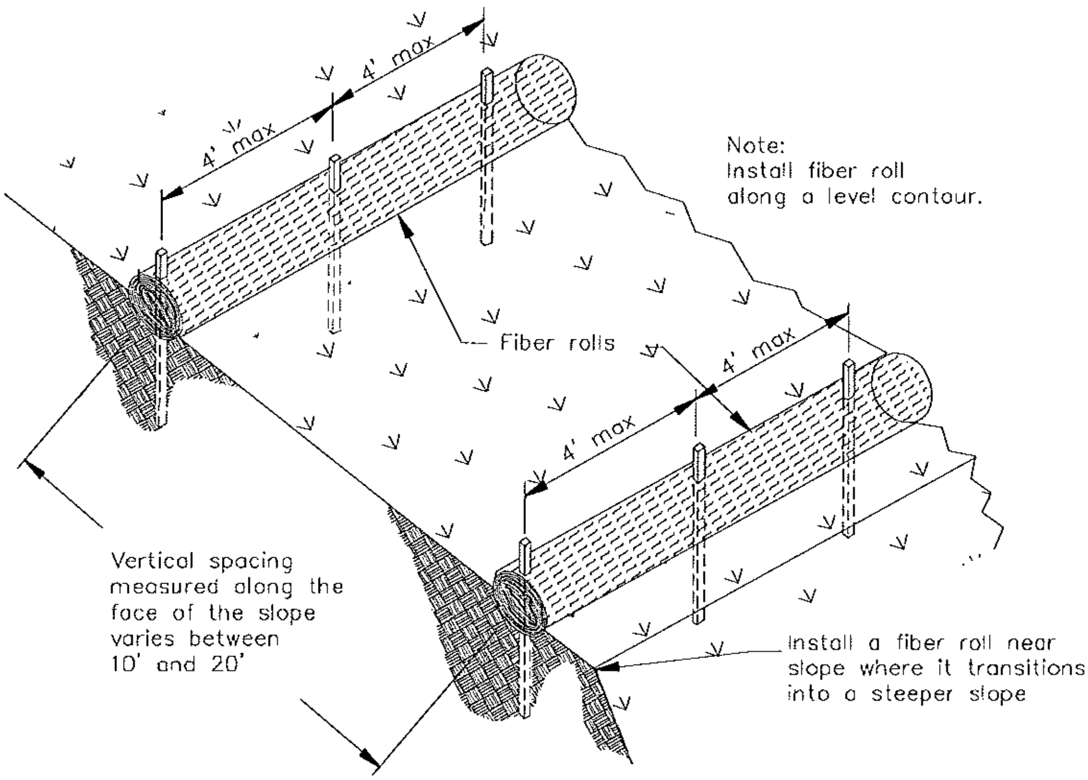
in order to maintain BMP effectiveness. Sediment should be removed when sediment accumulation reaches one-third the designated sediment storage depth.

- If fiber rolls are used for erosion control, such as in a check dam, sediment removal should not be required as long as the system continues to control the grade. Sediment control BMPs will likely be required in conjunction with this type of application.
- Repair any rills or gullies promptly.

References

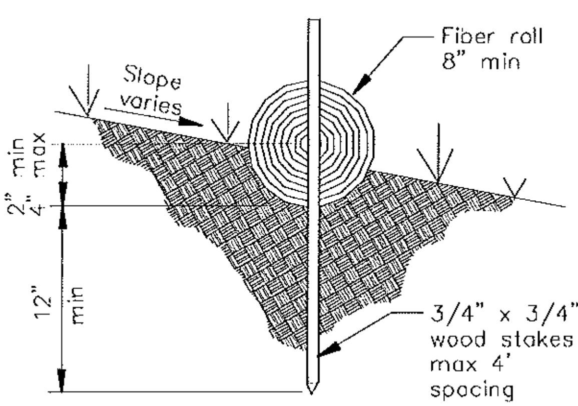
Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.



TYPICAL FIBER ROLL INSTALLATION

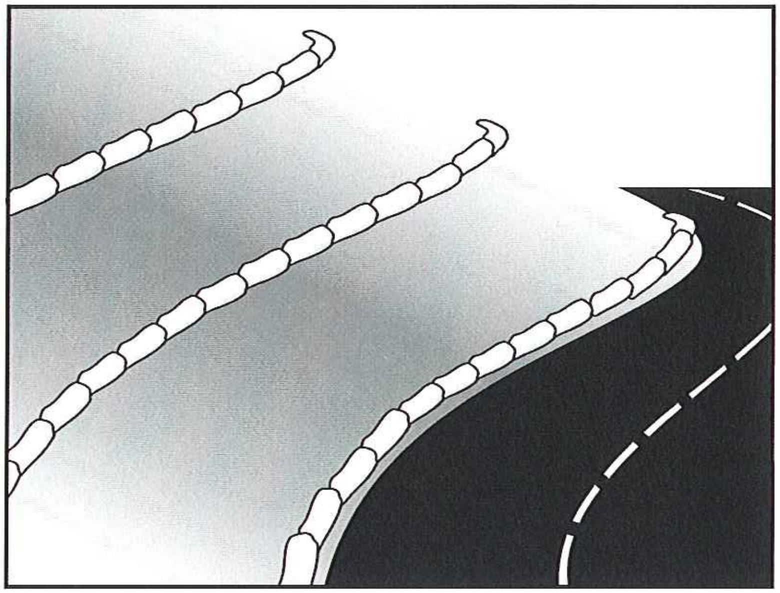
N.T.S.



ENTRENCHMENT DETAIL

N.T.S.

Gravel Bag Berm SE-6



Categories

EC	Erosion Control	☒
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Roll

SE-8 Sandbag Barrier

SE-14 Biofilter Bags

Description and Purpose

A gravel bag berm is a series of gravel-filled bags placed on a level contour to intercept sheet flows. Gravel bags pond sheet flow runoff, allowing sediment to settle out, and release runoff slowly as sheet flow, preventing erosion.

Suitable Applications

Gravel bag berms may be suitable:

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes
  - As sediment traps at culvert/pipe outlets
  - Below other small cleared areas
  - Along the perimeter of a site
  - Down slope of exposed soil areas
  - Around temporary stockpiles and spoil areas
  - Parallel to a roadway to keep sediment off paved areas
  - Along streams and channels
- As a linear erosion control measure:
  - Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.

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- At the top of slopes to divert runoff away from disturbed slopes.

- As chevrons (small check dams) across mildly sloped construction roads. For use check dam use in channels, see SE-4, Check Dams.

Limitations

- Gravel berms may be difficult to remove.

- Removal problems limit their usefulness in landscaped areas.

- Gravel bag berm may not be appropriate for drainage areas greater than 5 acres.

- Runoff will pond upstream of the berm, possibly causing flooding if sufficient space does not exist.

- Degraded gravel bags may rupture when removed, spilling contents.

- Installation can be labor intensive.

- Durability of gravel bags is somewhat limited and bags may need to be replaced when installation is required for longer than 6 months.

- Easily damaged by construction equipment.

- When used to detain concentrated flows, maintenance requirements increase.

Implementation

General

A gravel bag berm consists of a row of open graded gravel-filled bags placed on a level contour. When appropriately placed, a gravel bag berm intercepts and slows sheet flow runoff, causing temporary ponding. The temporary ponding allows sediment to settle. The open graded gravel in the bags is porous, which allows the ponded runoff to flow slowly through the bags, releasing the runoff as sheet flows. Gravel bag berms also interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets, which erode rills, and ultimately gullies, into disturbed, sloped soils. Gravel bag berms are similar to sand bag barriers, but are more porous. Generally, gravel bag berms should be used in conjunction with temporary soil stabilization controls up slope to provide effective erosion and sediment control.

Design and Layout

- Locate gravel bag berms on level contours.

- When used for slope interruption, the following slope/sheet flow length combinations apply:

  - Slope inclination of 4:1 (H:V) or flatter: Gravel bags should be placed at a maximum interval of 20 ft, with the first row near the slope toe.

  - Slope inclination between 4:1 and 2:1 (H:V): Gravel bags should be placed at a maximum interval of 15 ft. (a closer spacing is more effective), with the first row near the slope toe.

Slope inclination 2:1 (H:V) or greater: Gravel bags should be placed at a maximum interval of 10 ft. (a closer spacing is more effective), with the first row near the slope toe.

- Turn the ends of the gravel bag barriers up slope to prevent runoff from going around the berm.
- Allow sufficient space up slope from the gravel bag berm to allow ponding, and to provide room for sediment storage.
- For installation near the toe of the slope, gravel bag barriers should be set back from the slope toe to facilitate cleaning. Where specific site conditions do not allow for a set-back, the gravel bag barrier may be constructed on the toe of the slope. To prevent flows behind the barrier, bags can be placed perpendicular to a berm to serve as cross barriers.
- Drainage area should not exceed 5 acres.
- In Non-Traffic Areas:
  - Height = 18 in. maximum
  - Top width = 24 in. minimum for three or more layer construction
  - Top width = 12 in. minimum for one or two layer construction
  - Side slopes = 2:1 (H:V) or flatter
- In Construction Traffic Areas:
  - Height = 12 in. maximum
  - Top width = 24 in. minimum for three or more layer construction.
  - Top width = 12 in. minimum for one or two layer construction.
  - Side slopes = 2:1 (H:V) or flatter.
- Butt ends of bags tightly.
- On multiple row, or multiple layer construction, overlap butt joints of adjacent row and row beneath.
- Use a pyramid approach when stacking bags.

Materials

- ***Bag Material:*** Bags should be woven polypropylene, polyethylene or polyamide fabric or burlap, minimum unit weight of 4 ounces/yd^2, Mullen burst strength exceeding 300 lb/in^2 in conformance with the requirements in ASTM designation D3786, and ultraviolet stability exceeding 70% in conformance with the requirements in ASTM designation D4355.

- ***Bag Size:*** Each gravel-filled bag should have a length of 18 in., width of 12 in., thickness of 3 in., and mass of approximately 33 lbs. Bag dimensions are nominal, and may vary based on locally available materials.

- ***Fill Material:*** Fill material should be 0.5 to 1 in. crushed rock, clean and free from clay, organic matter, and other deleterious material, or other suitable open graded, non-cohesive, porous gravel.

Costs

Material costs for gravel bags are average and are dependent upon material availability. $2.50-3.00 per filled gravel bag is standard based upon vendor research.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Gravel bags exposed to sunlight will need to be replaced every two to three months due to degrading of the bags.

- Reshape or replace gravel bags as needed.

- Repair washouts or other damage as needed.

- Sediment that accumulates in the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.

- Remove gravel bag berms when no longer needed and recycle gravel fill whenever possible and properly dispose of bag material. Remove sediment accumulation and clean, re-grade, and stabilize the area.

References

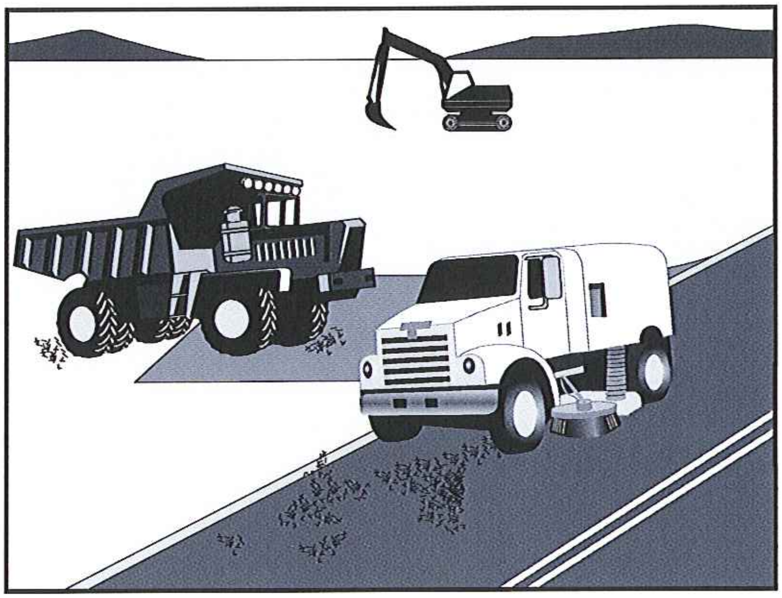
Handbook of Steel Drainage and Highway Construction, American Iron and Steel Institute, 1983.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Pollution Plan Handbook, First Edition, State of California, Department of Transportation Division of New Technology, Materials and Research, October 1992.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Street Sweeping and Vacuuming SE-7



Categories

EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

Street sweeping and vacuuming includes use of self-propelled and walk-behind equipment to remove sediment from streets and roadways, and to clean paved surfaces in preparation for final paving. Sweeping and vacuuming prevents sediment from the project site from entering storm drains or receiving waters.

Suitable Applications

Sweeping and vacuuming are suitable anywhere sediment is tracked from the project site onto public or private paved streets and roads, typically at points of egress. Sweeping and vacuuming are also applicable during preparation of paved surfaces for final paving.

Limitations

Sweeping and vacuuming may not be effective when sediment is wet or when tracked soil is caked (caked soil may need to be scraped loose).

Implementation

- Controlling the number of points where vehicles can leave the site will allow sweeping and vacuuming efforts to be focused, and perhaps save money.
- Inspect potential sediment tracking locations daily.
- Visible sediment tracking should be swept or vacuumed on a daily basis.
- Do not use kick brooms or sweeper attachments. These tend to spread the dirt rather than remove it.

- If not mixed with debris or trash, consider incorporating the removed sediment back into the project

Costs

Rental rates for self-propelled sweepers vary depending on hopper size and duration of rental. Expect rental rates from $58/hour (3 yd^3 hopper) to $88/hour (9 yd^3 hopper), plus operator costs. Hourly production rates vary with the amount of area to be swept and amount of sediment. Match the hopper size to the area and expect sediment load to minimize time spent dumping.

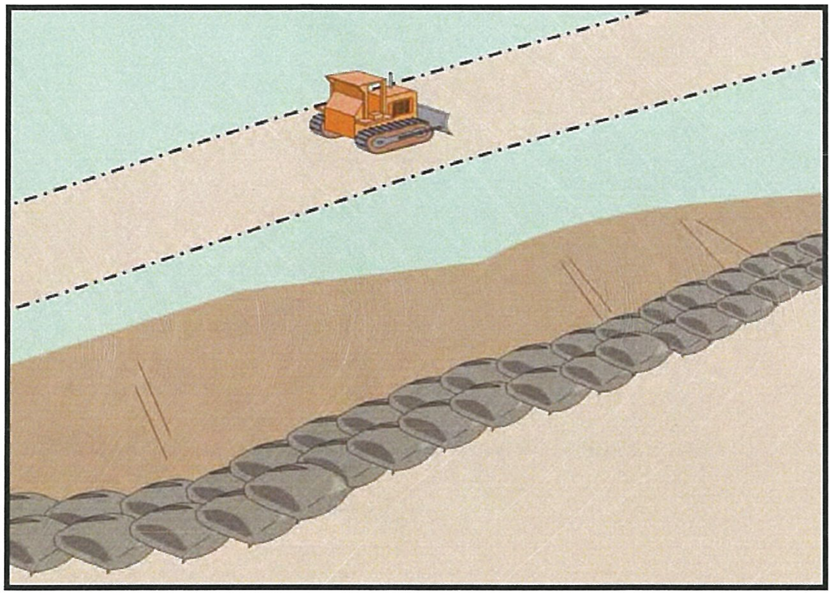
Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- When actively in use, points of ingress and egress must be inspected daily.
- When tracked or spilled sediment is observed outside the construction limits, it must be removed at least daily. More frequent removal, even continuous removal, may be required in some jurisdictions.
- Be careful not to sweep up any unknown substance or any object that may be potentially hazardous.
- Adjust brooms frequently; maximize efficiency of sweeping operations.
- After sweeping is finished, properly dispose of sweeper wastes at an approved dumpsite.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Labor Surcharge and Equipment Rental Rates, State of California Department of Transportation (Caltrans), April 1, 2002 – March 31, 2003.



Categories

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Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-14 Biofilter Bags

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Description and Purpose

A sandbag barrier is a series of sand-filled bags placed on a level contour to intercept or to divert sheet flows. Sandbag barriers placed on a level contour pond sheet flow runoff, allowing sediment to settle out.

Suitable Applications

Sandbag barriers may be suitable:

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes.
  - As sediment traps at culvert/pipe outlets.
  - Below other small cleared areas.
  - Along the perimeter of a site.
  - Down slope of exposed soil areas.
  - Around temporary stockpiles and spoil areas.
  - Parallel to a roadway to keep sediment off paved areas.
  - Along streams and channels.
- As linear erosion control measure:
  - Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.

- At the top of slopes to divert runoff away from disturbed slopes.
- As check dams across mildly sloped construction roads.

Limitations

- It is necessary to limit the drainage area upstream of the barrier to 5 acres.
- Sandbags are not intended to be used as filtration devices.
- Easily damaged by construction equipment.
- Degraded sandbags may rupture when removed, spilling sand.
- Sand is easily transported by runoff if bag is damaged or ruptured.
- Installation can be labor intensive.
- Durability of sandbags is somewhat limited and bags may need to be replaced when installation is required for longer than 6 months. When used to detain concentrated flows, maintenance requirements increase.
- Burlap should not be used for sandbags.

Implementation

General

A sandbag barrier consists of a row of sand-filled bags placed on a level contour. When appropriately placed, a sandbag barrier intercepts and slows sheet flow runoff, causing temporary ponding. The temporary ponding allows sediment to settle. Sand-filled bags have limited porosity, which is further limited as the fine sand tends to quickly plug with sediment, limiting or completely blocking the rate of flow through the barrier. If a porous barrier is desired, consider SE-1, Silt Fence, SE-5, Fiber Rolls, SE-6, Gravel Bag Berms or SE-14, Biofilter Bags. Sandbag barriers also interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets which erode rills, and ultimately gullies, into disturbed, sloped soils. Sandbag barriers are similar to gravel bag berms, but less porous. Generally, sandbag barriers should be used in conjunction with temporary soil stabilization controls up slope to provide effective erosion and sediment control.

Design and Layout

- Locate sandbag barriers on a level contour.
- When used for slope interruption, the following slope/sheet flow length combinations apply:
  - Slope inclination of 4:1 (H:V) or flatter: Sandbags should be placed at a maximum interval of 20 ft, with the first row near the slope toe.
  - Slope inclination between 4:1 and 2:1 (H:V): Sandbags should be placed at a maximum interval of 15 ft. (a closer spacing is more effective), with the first row near the slope toe.
  - Slope inclination 2:1 (H:V) or greater: Sandbags should be placed at a maximum interval of 10 ft. (a closer spacing is more effective), with the first row near the slope toe.

- Turn the ends of the sandbag barrier up slope to prevent runoff from going around the barrier.
- Allow sufficient space up slope from the barrier to allow ponding, and to provide room for sediment storage.
- For installation near the toe of the slope, sand bag barriers should be set back from the slope toe to facilitate cleaning. Where specific site conditions do not allow for a set-back, the sand bag barrier may be constructed on the toe of the slope. To prevent flows behind the barrier, bags can be placed perpendicular to a berm to serve as cross barriers.
- Drainage area should not exceed 5 acres.
- Stack sandbags at least three bags high.
- Butt ends of bags tightly.
- Overlap butt joints of row beneath with each successive row.
- Use a pyramid approach when stacking bags.
- In non-traffic areas
  - Height = 18 in. maximum
  - Top width = 24 in. minimum for three or more layer construction
  - Side slope = 2:1 (H:V) or flatter
- In construction traffic areas
  - Height = 12 in. maximum
  - Top width = 24 in. minimum for three or more layer construction.
  - Side slopes = 2:1 (H:V) or flatter.
- See typical sandbag barrier installation details at the end of this fact sheet.

Materials

- ***Sandbag Material:*** Sandbag should be woven polypropylene, polyethylene or polyamide fabric, minimum unit weight of 4 ounces/yd^2, Mullen burst strength exceeding 300 lb/in^2 in conformance with the requirements in ASTM designation D3786, and ultraviolet stability exceeding 70% in conformance with the requirements in ASTM designation D4355. Use of burlap is not an acceptable substitute, as sand can more easily mobilize out of burlap.
- ***Sandbag Size:*** Each sand-filled bag should have a length of 18 in., width of 12 in., thickness of 3 in., and mass of approximately 33 lbs. Bag dimensions are nominal, and may vary based on locally available materials.

- ***Fill Material:*** All sandbag fill material should be non-cohesive, Class 3 (Caltrans Standard Specification, Section 25) permeable material free from clay and deleterious material, such as recycled concrete or asphalt..

Costs

Empty sandbags cost $0.25 - $0.75. Average cost of fill material is $8 per yd^3. Additional labor is required to fill the bags. Pre-filled sandbags are more expensive at $1.50 - $2.00 per bag. These costs are based upon vendor research.

Inspection and Maintenance

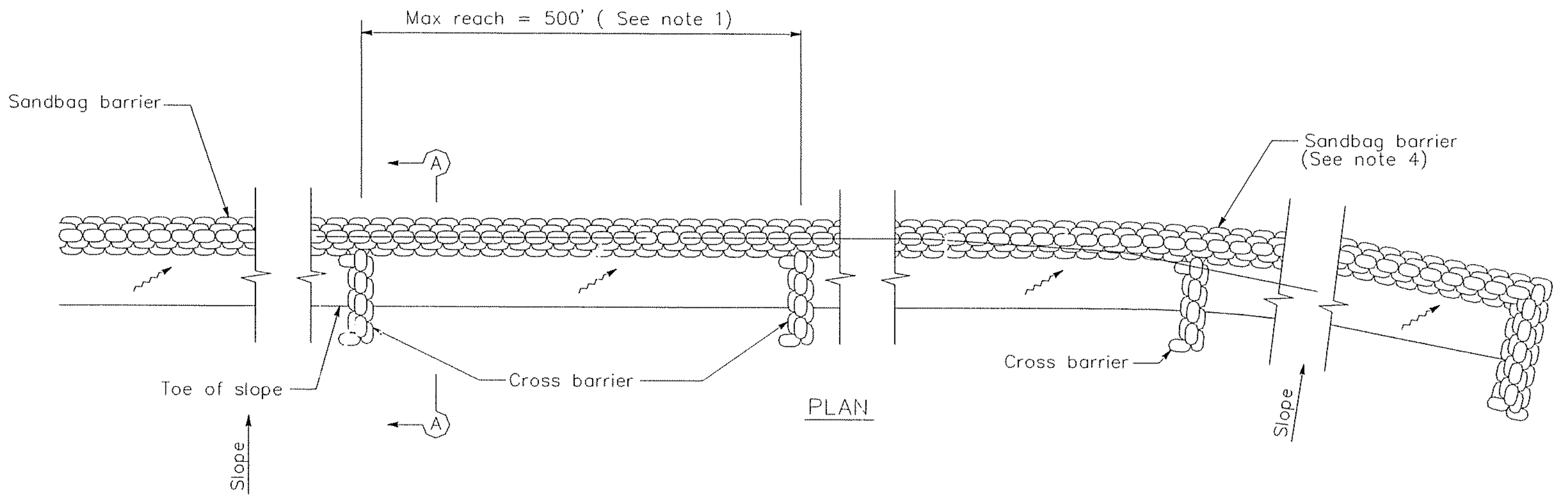
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Sandbags exposed to sunlight will need to be replaced every two to three months due to degradation of the bags.
- Reshape or replace sandbags as needed.
- Repair washouts or other damage as needed.
- Sediment that accumulates behind the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- Remove sandbags when no longer needed and recycle sand fill whenever possible and properly dispose of bag material. Remove sediment accumulation, and clean, re-grade, and stabilize the area.

References

Standard Specifications for Construction of Local Streets and Roads, California Department of Transportation (Caltrans), July 2002.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

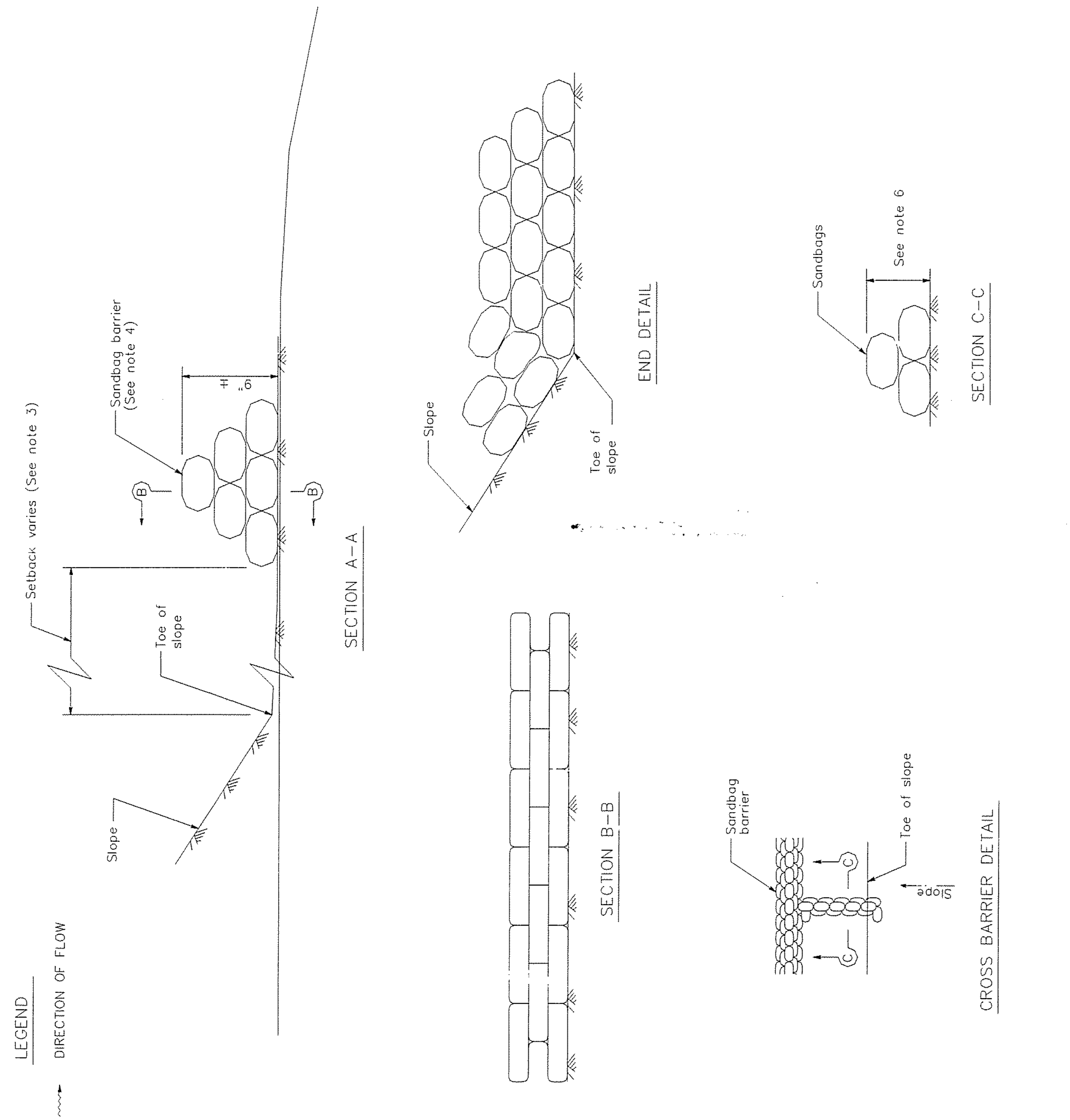
Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.



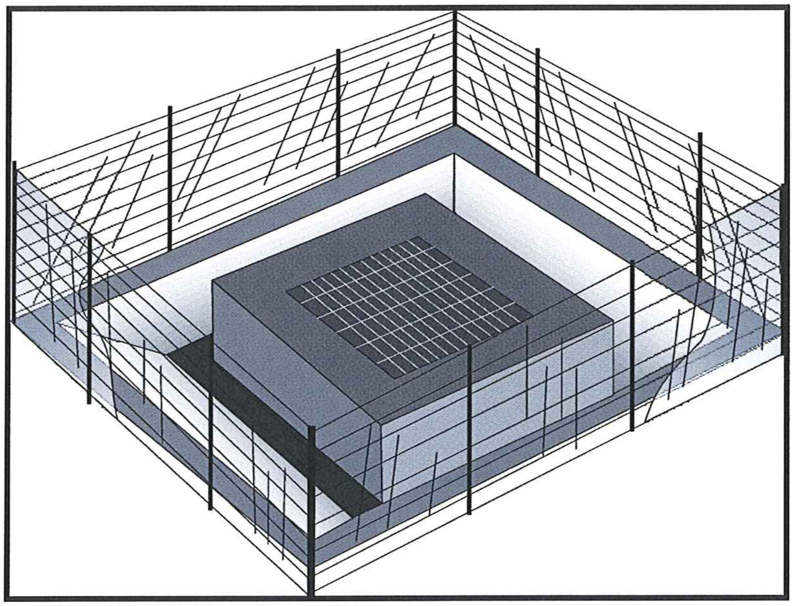
SANDBAG BARRIER

NOTES

1. Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/2 the height of the linear barrier. In no case shall the reach length exceed 500'.
2. Place sandbags tightly.
3. Dimension may vary to fit field condition.
4. Sandbag barrier shall be a minimum of 3 bags high.
5. The end of the barrier shall be turned up slope.
6. Cross barriers shall be a min of 1/2 and a max of 2/3 the height of the linear barrier.
7. Sandbag rows and layers shall be staggered to eliminate gaps.



LEGEND
DIRECTION OF FLOW
Slope
Toe of slope
Setback varies (See note 3)
Sandbag barrier (See note 4)
9" ±
B
SECTION A–A
Slope
Toe of slope
END DETAIL
SECTION B–B
Sandbags
See note 6
SECTION C–C
Sandbag barrier
Toe of slope
Slope
C
CROSS BARRIER DETAIL



Categories

EC	Erosion Control	
SE	Sediment Control	☑
TC	Tracking Control	
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Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☒
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-14 Biofilter Bags

Description and Purpose

Storm drain inlet protection consists of a sediment filter or an impounding area in, around or upstream of a storm drain, drop inlet, or curb inlet. Storm drain inlet protection measures temporarily pond runoff before it enters the storm drain, allowing sediment to settle. Some filter configurations also remove sediment by filtering, but usually the ponding action results in the greatest sediment reduction. Temporary geotextile storm drain inserts attach underneath storm drain grates to capture and filter storm water.

Suitable Applications

Every storm drain inlet receiving runoff from unstabilized or otherwise active work areas should be protected. Inlet protection should be used in conjunction with other erosion and sediment controls to prevent sediment-laden stormwater and non-stormwater discharges from entering the storm drain system.

Limitations

- Drainage area should not exceed 1 acre.
- In general straw bales should not be used as inlet protection.
- Requires an adequate area for water to pond without encroaching into portions of the roadway subject to traffic.

- Sediment removal may be inadequate to prevent sediment discharges in high flow conditions or if runoff is heavily sediment laden. If high flow conditions are expected, use other onsite sediment trapping techniques in conjunction with inlet protection.
- Frequent maintenance is required.
- Limit drainage area to 1 acre maximum. For drainage areas larger than 1 acre, runoff should be routed to a sediment-trapping device designed for larger flows. See BMPs SE-2, Sediment Basin, and SE-3, Sediment Traps.
- Excavated drop inlet sediment traps are appropriate where relatively heavy flows are expected, and overflow capability is needed.

Implementation

General

Inlet control measures presented in this handbook should not be used for inlets draining more than one acre. Runoff from larger disturbed areas should be first routed through SE-2, Sediment Basin or SE-3, Sediment Trap and/or used in conjunction with other drainage control, erosion control, and sediment control BMPs to protect the site. Different types of inlet protection are appropriate for different applications depending on site conditions and the type of inlet. Alternative methods are available in addition to the methods described/shown herein such as prefabricated inlet insert devices, or gutter protection devices.

Design and Layout

Identify existing and planned storm drain inlets that have the potential to receive sediment-laden surface runoff. Determine if storm drain inlet protection is needed and which method to use.

- The key to successful and safe use of storm drain inlet protection devices is to know where runoff that is directed toward the inlet to be protected will pond or be diverted as a result of installing the protection device.
  - Determine the acceptable location and extent of ponding in the vicinity of the drain inlet. The acceptable location and extent of ponding will influence the type and design of the storm drain inlet protection device.
  - Determine the extent of potential runoff diversion caused by the storm drain inlet protection device. Runoff ponded by inlet protection devices may flow around the device and towards the next downstream inlet. In some cases, this is acceptable; in other cases, serious erosion or downstream property damage can be caused by these diversions. The possibility of runoff diversions will influence whether or not storm drain inlet protection is suitable; and, if suitable, the type and design of the device.
- The location and extent of ponding, and the extent of diversion, can usually be controlled through appropriate placement of the inlet protection device. In some cases, moving the inlet protection device a short distance upstream of the actual inlet can provide more efficient sediment control, limit ponding to desired areas, and prevent or control diversions.

- Six types of inlet protection are presented below. However, it is recognized that other effective methods and proprietary devices exist and may be selected.
  - Silt Fence: Appropriate for drainage basins with less than a 5% slope, sheet flows, and flows under 0.5 cfs.
  - Excavated Drop Inlet Sediment Trap: An excavated area around the inlet to trap sediment (SE-3).
  - Gravel bag barrier: Used to create a small sediment trap upstream of inlets on sloped, paved streets. Appropriate for sheet flow or when concentrated flow may exceed 0.5 cfs, and where overtopping is required to prevent flooding.
  - Block and Gravel Filter: Appropriate for flows greater than 0.5 cfs.
  - Temporary Geotextile Storm drain Inserts: Different products provide different features. Refer to manufacturer details for targeted pollutants and additional features.
  - Biofilter Bag Barrier: Used to create a small retention area upstream of inlets and can be located on pavement or soil. Biofilter bags slowly filter runoff allowing sediment to settle out. Appropriate for flows under 0.5 cfs.
- Select the appropriate type of inlet protection and design as referred to or as described in this fact sheet.
- Provide area around the inlet for water to pond without flooding structures and property.
- Grates and spaces around all inlets should be sealed to prevent seepage of sediment-laden water.
- Excavate sediment sumps (where needed) 1 to 2 ft with 2:1 side slopes around the inlet.

Installation

- ***DI Protection Type 1 - Silt Fence*** - Similar to constructing a silt fence; see BMP SE-1, Silt Fence. Do not place fabric underneath the inlet grate since the collected sediment may fall into the drain inlet when the fabric is removed or replaced and water flow through the grate will be blocked resulting in flooding. See typical Type 1 installation details at the end of this fact sheet.
  1. Excavate a trench approximately 6 in. wide and 6 in. deep along the line of the silt fence inlet protection device.
  2. Place 2 in. by 2 in. wooden stakes around the perimeter of the inlet a maximum of 3 ft apart and drive them at least 18 in. into the ground or 12 in. below the bottom of the trench. The stakes should be at least 48 in.
  3. Lay fabric along bottom of trench, up side of trench, and then up stakes. See SE-1, Silt Fence, for details. The maximum silt fence height around the inlet is 24 in.
  4. Staple the filter fabric (for materials and specifications, see SE-1, Silt Fence) to wooden stakes. Use heavy-duty wire staples at least 1 in. in length.

5. Backfill the trench with gravel or compacted earth all the way around.

- ***DI Protection Type 2 - Excavated Drop Inlet Sediment Trap*** - Install filter fabric fence in accordance with DI Protection Type 1. Size excavated trap to provide a minimum storage capacity calculated at the rate 67 yd^3/acre of drainage area. See typical Type 2 installation details at the end of this fact sheet.

- ***DI Protection Type 3 - Gravel bag*** - Flow from a severe storm should not overtop the curb. In areas of high clay and silts, use filter fabric and gravel as additional filter media. Construct gravel bags in accordance with SE-6, Gravel Bag Berm. Gravel bags should be used due to their high permeability. See typical Type 3 installation details at the end of this fact sheet.

  1. Construct on gently sloping street.

  2. Leave room upstream of barrier for water to pond and sediment to settle.

  3. Place several layers of gravel bags – overlapping the bags and packing them tightly together.

  4. Leave gap of one bag on the top row to serve as a spillway. Flow from a severe storm (e.g., 10 year storm) should not overtop the curb.

- ***DI Protection Type 4 – Block and Gravel Filter*** - Block and gravel filters are suitable for curb inlets commonly used in residential, commercial, and industrial construction. See typical Type 4 installation details at the end of this fact sheet.

  1. Place hardware cloth or comparable wire mesh with 0.5 in. openings over the drop inlet so that the wire extends a minimum of 1 ft beyond each side of the inlet structure. If more than one strip is necessary, overlap the strips. Place woven geotextile over the wire mesh.

  2. Place concrete blocks lengthwise on their sides in a single row around the perimeter of the inlet, so that the open ends face outward, not upward. The ends of adjacent blocks should abut. The height of the barrier can be varied, depending on design needs, by stacking combinations of blocks that are 4 in., 8 in., and 12 in. wide. The row of blocks should be at least 12 in. but no greater than 24 in. high.

  3. Place wire mesh over the outside vertical face (open end) of the concrete blocks to prevent stone from being washed through the blocks. Use hardware cloth or comparable wire mesh with 0.5 in. opening.

  4. Pile washed stone against the wire mesh to the top of the blocks. Use 0.75 to 3 in.

- ***DI Protection Type 5 – Temporary Geotextile Insert (proprietary)*** – Many types of temporary inserts are available. Most inserts fit underneath the grate of a drop inlet or inside of a curb inlet and are fastened to the outside of the grate or curb. These inserts are removable and many can be cleaned and reused. Installation of these inserts differs between manufacturers. Please refer to manufacturer instruction for installation of proprietary devices.

- ***DI Protection Type 6 - Biofilter bags*** – Biofilter bags may be used as a substitute for gravel bags in low-flow situations. Biofilter bags should conform to specifications detailed in SE-14, Biofilter bags.

  1. Construct in a gently sloping area.
  2. Biofilter bags should be placed around inlets to intercept runoff flows.
  3. All bag joints should overlap by 6 in.
  4. Leave room upstream for water to pond and for sediment to settle out.
  5. Stake bags to the ground as described in the following detail. Stakes may be omitted if bags are placed on a paved surface.

Costs

- Average annual cost for installation and maintenance of DI Type 1-4 and 6 (one year useful life) is $200 per inlet.

- Temporary geotextile inserts are proprietary and cost varies by region. These inserts can often be reused and may have greater than 1 year of use if maintained and kept undamaged. Average cost per insert ranges from $50-75 plus installation, but costs can exceed $100. This cost does not include maintenance.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Silt Fences. If the fabric becomes clogged, torn, or degrades, it should be replaced. Make sure the stakes are securely driven in the ground and are in good shape (i.e., not bent, cracked, or splintered, and are reasonably perpendicular to the ground). Replace damaged stakes. At a minimum, remove the sediment behind the fabric fence when accumulation reaches one-third the height of the fence or barrier height.

- Gravel Filters. If the gravel becomes clogged with sediment, it should be carefully removed from the inlet and either cleaned or replaced. Since cleaning gravel at a construction site may be difficult, consider using the sediment-laden stone as fill material and put fresh stone around the inlet. Inspect bags for holes, gashes, and snags, and replace bags as needed. Check gravel bags for proper arrangement and displacement.

- Sediment that accumulates in the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.

- Inspect and maintain temporary geotextile insert devices according to manufacturer's specifications.

- Remove storm drain inlet protection once the drainage area is stabilized.

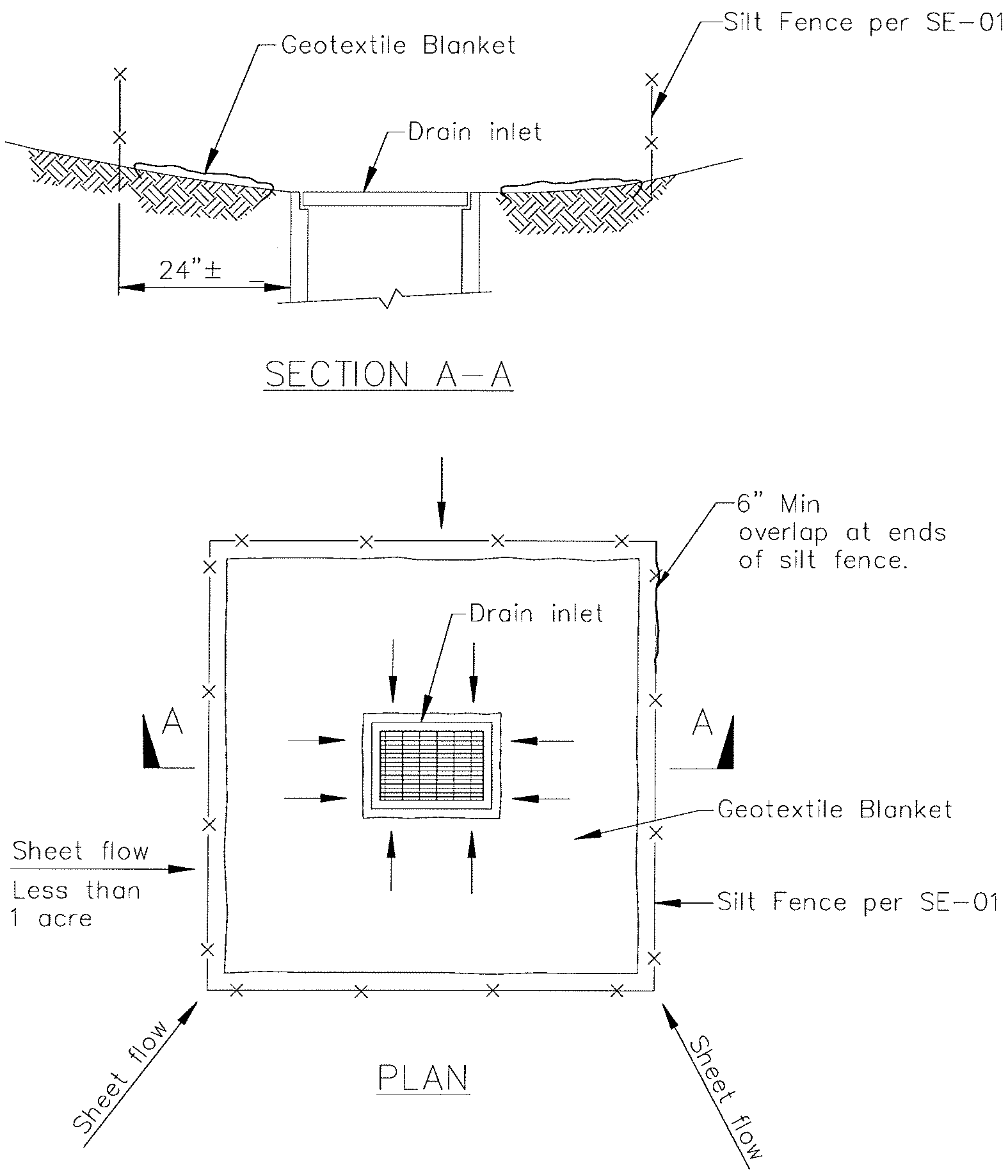
- Clean and regrade area around the inlet and clean the inside of the storm drain inlet, as it should be free of sediment and debris at the time of final inspection.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management Manual for The Puget Sound Basin, Washington State Department of Ecology, Public Review Draft, 1991.

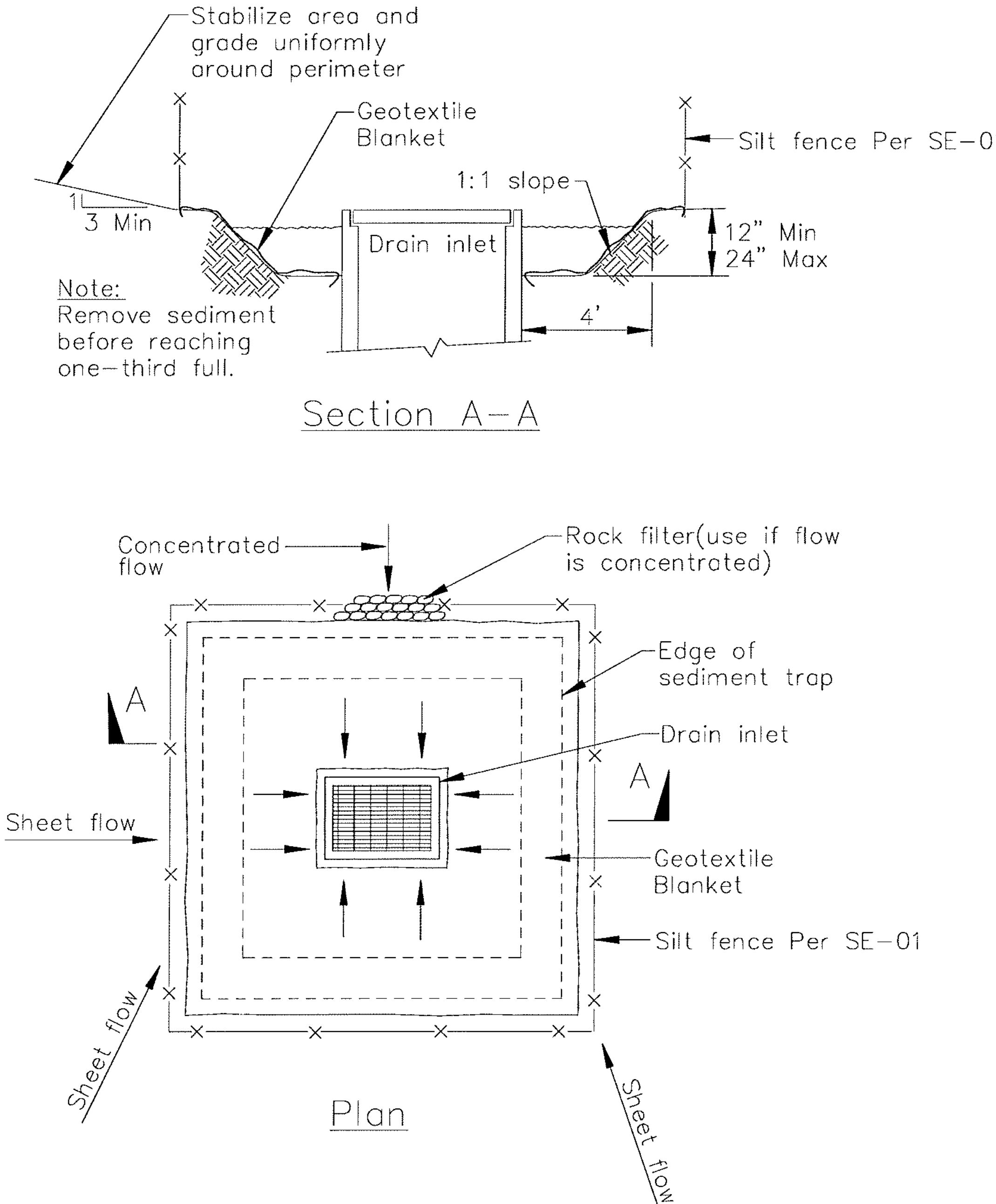
Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.



DI PROTECTION TYPE 1
NOT TO SCALE

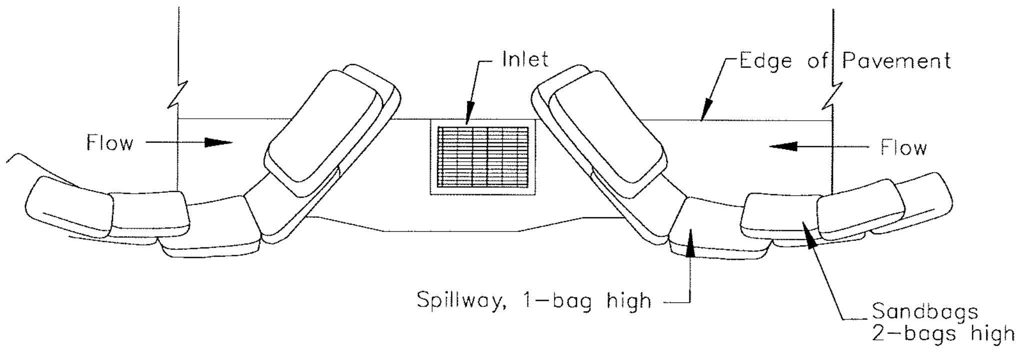
NOTES:

1. For use in areas where grading has been completed and final soil stabilization and seeding are pending.
2. Not applicable in paved areas.
3. Not applicable with concentrated flows.

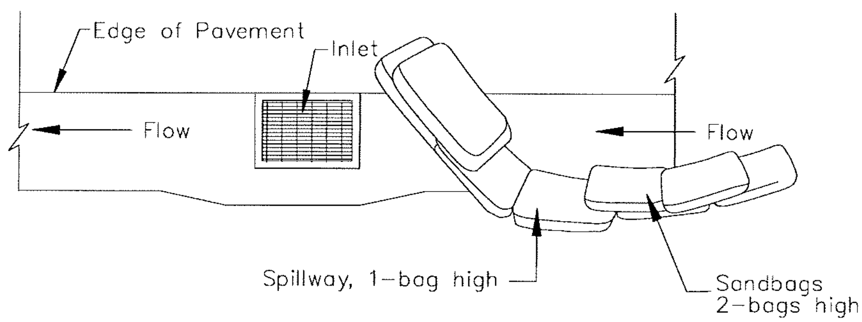


DI PROTECTION TYPE 2
NOT TO SCALE

Notes
1. For use in cleared and grubbed and in graded areas.
2. Shape basin so that longest inflow area faces longest length of trap.
3. For concentrated flows, shape basin in 2:1 ratio with length oriented towards direction of flow.



TYPICAL PROTECTION FOR INLET ON SUMP

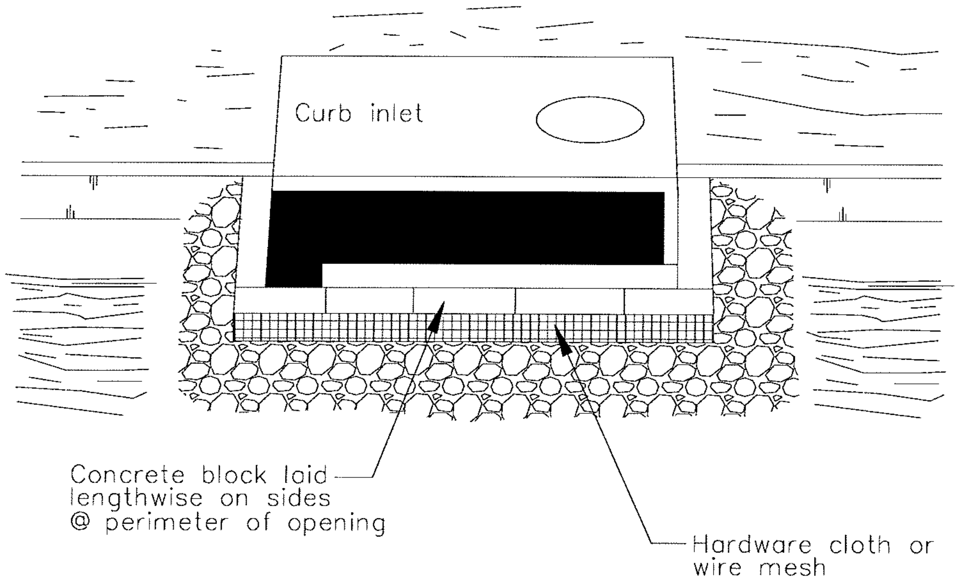


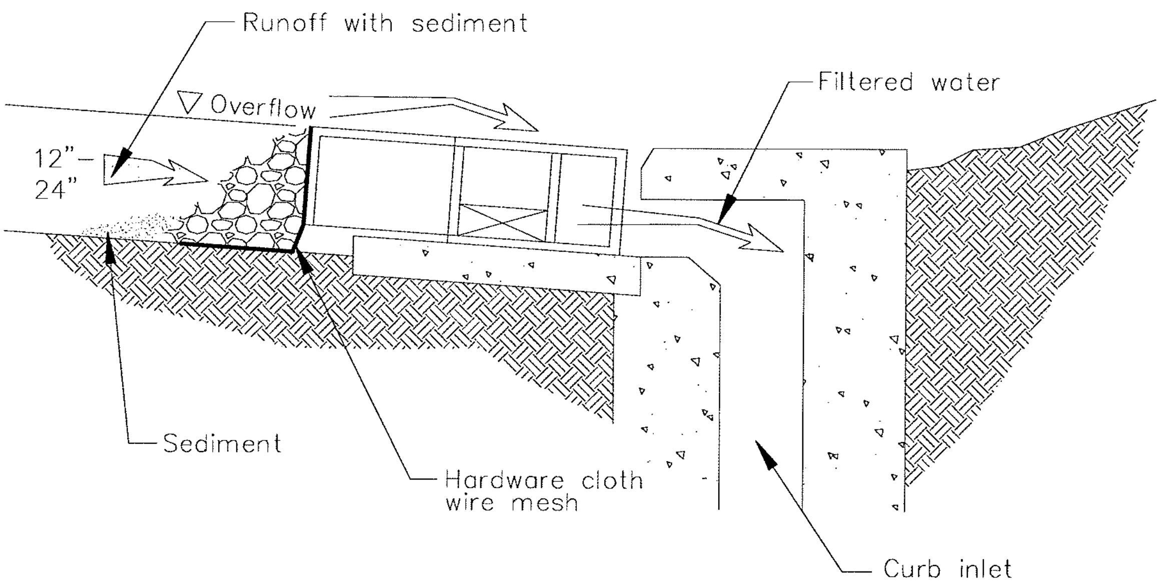
TYPICAL PROTECTION FOR INLET ON GRADE

NOTES:

1. Intended for short–term use.
2. Use to inhibit non–storm water flow.
3. Allow for proper maintenance and cleanup.
4. Bags must be removed after adjacent operation is completed
5. Not applicable in areas with high silts and clays without filter fabric.

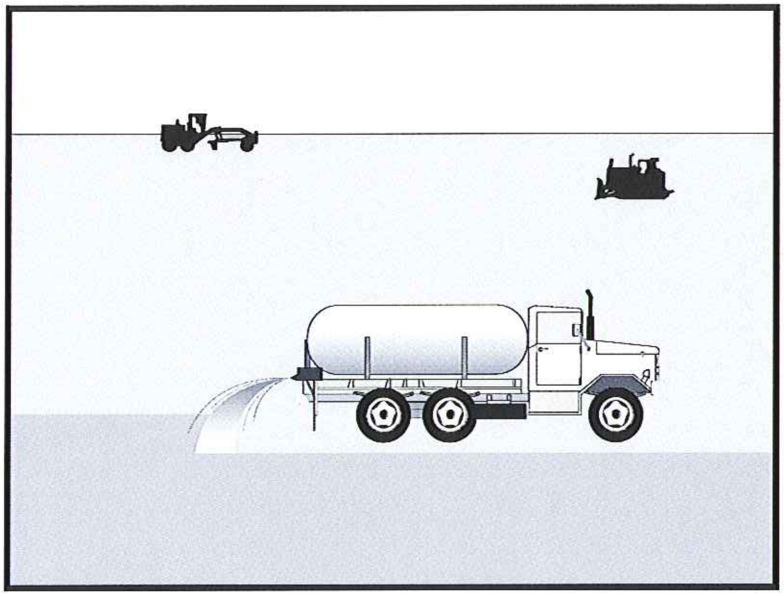
DI PROTECTION TYPE 3
NOT TO SCALE





DI PROTECTION – TYPE 4

NOT TO SCALE



Categories

EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	☑
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-5 Soil Binders

Description and Purpose

Wind erosion or dust control consists of applying water or other chemical dust suppressants as necessary to prevent or alleviate dust nuisance generated by construction activities. Covering small stockpiles or areas is an alternative to applying water or other dust palliatives.

California's Mediterranean climate, with a short "wet" season and a typically long, hot "dry" season, allows the soils to thoroughly dry out. During the dry season, construction activities are at their peak, and disturbed and exposed areas are increasingly subject to wind erosion, sediment tracking and dust generated by construction equipment. Site conditions and climate can make dust control more of an erosion problem than water based erosion. Additionally, many local agencies, including Air Quality Management Districts, require dust control and/or dust control permits in order to comply with local nuisance laws, opacity laws (visibility impairment) and the requirements of the Clean Air Act. Wind erosion control is required to be implemented at all construction sites greater than 1 acre by the General Permit.

Suitable Applications

Most BMPs that provide protection against water-based erosion will also protect against wind-based erosion and dust control requirements required by other agencies will generally meet wind erosion control requirements for water quality protection. Wind erosion control BMPs are suitable during the following construction activities:

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- Construction vehicle traffic on unpaved roads
- Drilling and blasting activities
- Soils and debris storage piles
- Batch drop from front-end loaders
- Areas with unstabilized soil
- Final grading/site stabilization

Limitations

- Watering prevents dust only for a short period (generally less than a few hours) and should be applied daily (or more often) to be effective.
- Over watering may cause erosion and track-out.
- Oil or oil-treated subgrade should not be used for dust control because the oil may migrate into drainageways and/or seep into the soil.
- Chemical dust suppression agents may have potential environmental impacts. Selected chemical dust control agents should be environmentally benign.
- Effectiveness of controls depends on soil, temperature, humidity, wind velocity and traffic.
- Chemical dust suppression agents should not be used within 100 feet of wetlands or water bodies.
- Chemically treated subgrades may make the soil water repellant, interfering with long-term infiltration and the vegetation/re-vegetation of the site. Some chemical dust suppressants may be subject to freezing and may contain solvents and should be handled properly.
- In compacted areas, watering and other liquid dust control measures may wash sediment or other constituents into the drainage system.
- If the soil surface has minimal natural moisture, the affected area may need to be pre-wetted so that chemical dust control agents can uniformly penetrate the soil surface.

Implementation

Dust Control Practices

Dust control BMPs generally stabilize exposed surfaces and minimize activities that suspend or track dust particles. The following table presents dust control practices that can be applied to varying site conditions that could potentially cause dust. For heavily traveled and disturbed areas, wet suppression (watering), chemical dust suppression, gravel asphalt surfacing, temporary gravel construction entrances, equipment wash-out areas, and haul truck covers can be employed as dust control applications. Permanent or temporary vegetation and mulching can be employed for areas of occasional or no construction traffic. Preventive measures include minimizing surface areas to be disturbed, limiting onsite vehicle traffic to 15 mph or less, and controlling the number and activity of vehicles on a site at any given time.

Chemical dust suppressants include: mulch and fiber based dust palliatives (e.g. paper mulch with gypsum binder), salts and brines (e.g. calcium chloride, magnesium chloride), non-petroleum based organics (e.g. vegetable oil, lignosulfonate), petroleum based organics (e.g. asphalt emulsion, dust oils, petroleum resins), synthetic polymers (e.g. polyvinyl acetate, vinyls, acrylic), clay additives (e.g. bentonite, montimorillonite) and electrochemical products (e.g. enzymes, ionic products).

Site Condition	Dust Control Practices							
	Permanent Vegetation	Mulching	Wet Suppression (Watering)	Chemical Dust Suppression	Gravel or Asphalt	Temporary Gravel Construction Entrances/Equipment Wash Down	Synthetic Covers	Minimize Extent of Disturbed Area
Disturbed Areas not Subject to Traffic	X	X	X	X	X			X
Disturbed Areas Subject to Traffic			X	X	X	X		X
Material Stockpiles		X	X	X			X	X
Demolition			X			X	X	
Clearing/ Excavation			X	X				X
Truck Traffic on Unpaved Roads			X	X	X	X	X	
Tracking					X	X		

Additional preventive measures include:

- Schedule construction activities to minimize exposed area (see EC-1, Scheduling).
- Quickly treat exposed soils using water, mulching, chemical dust suppressants, or stone/gravel layering.
- Identify and stabilize key access points prior to commencement of construction.
- Minimize the impact of dust by anticipating the direction of prevailing winds.
- Restrict construction traffic to stabilized roadways within the project site, as practicable.
- Water should be applied by means of pressure-type distributors or pipelines equipped with a spray system or hoses and nozzles that will ensure even distribution.
- All distribution equipment should be equipped with a positive means of shutoff.
- Unless water is applied by means of pipelines, at least one mobile unit should be available at all times to apply water or dust palliative to the project.
- If reclaimed waste water is used, the sources and discharge must meet California Department of Health Services water reclamation criteria and the Regional Water Quality

Control Board (RWQCB) requirements. Non-potable water should not be conveyed in tanks or drain pipes that will be used to convey potable water and there should be no connection between potable and non-potable supplies. Non-potable tanks, pipes, and other conveyances should be marked, "NON-POTABLE WATER - DO NOT DRINK."

- Pave or chemically stabilize access points where unpaved traffic surfaces adjoin paved roads.
- Provide covers for haul trucks transporting materials that contribute to dust.
- Provide for rapid clean up of sediments deposited on paved roads. Furnish stabilized construction road entrances and wheel wash areas.
- Stabilize inactive areas of construction sites using temporary vegetation or chemical stabilization methods.

For chemical stabilization, there are many products available for chemically stabilizing gravel roadways and stockpiles. If chemical stabilization is used, the chemicals should not create any adverse effects on stormwater, plant life, or groundwater and should meet all applicable regulatory requirements.

Costs

Installation costs for water and chemical dust suppression vary based on the method used and the length of effectiveness. Annual costs may be high since some of these measures are effective for only a few hours to a few days.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Check areas protected to ensure coverage.
- Most water-based dust control measures require frequent application, often daily or even multiple times per day. Obtain vendor or independent information on longevity of chemical dust suppressants.

References

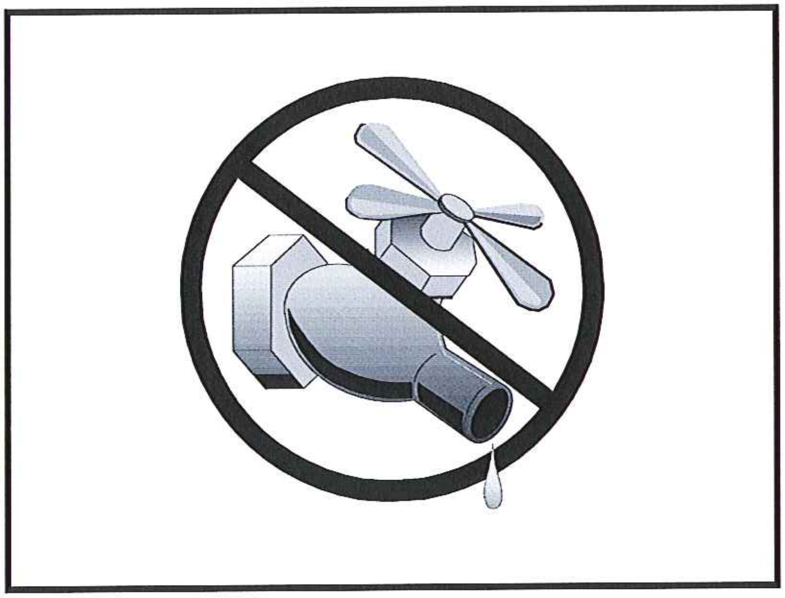
Best Management Practices and Erosion Control Manual for Construction Sites, Flood Control District of Maricopa County, Arizona, September 1992.

California Air Pollution Control Laws, California Air Resources Board, updated annually.

Construction Manual, Chapter 4, Section 10, "Dust Control"; Section 17, "Watering"; and Section 18, "Dust Palliative", California Department of Transportation (Caltrans), July 2001.

Prospects for Attaining the State Ambient Air Quality Standards for Suspended Particulate Matter (PM10), Visibility Reducing Particles, Sulfates, Lead, and Hydrogen Sulfide, California Air Resources Board, April 1991.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.



Categories

EC	Erosion Control	☒
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	
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WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Water conservation practices are activities that use water during the construction of a project in a manner that avoids causing erosion and the transport of pollutants offsite. These practices can reduce or eliminate non-stormwater discharges.

Suitable Applications

Water conservation practices are suitable for all construction sites where water is used, including piped water, metered water, trucked water, and water from a reservoir.

Limitations

- None identified.

Implementation

- Keep water equipment in good working condition.
- Stabilize water truck filling area.
- Repair water leaks promptly.
- Washing of vehicles and equipment on the construction site is discouraged.
- Avoid using water to clean construction areas. If water must be used for cleaning or surface preparation, surface should be swept and vacuumed first to remove dirt. This will minimize amount of water required.
- Direct construction water runoff to areas where it can soak

into the ground or be collected and reused.

- Authorized non-stormwater discharges to the storm drain system, channels, or receiving waters are acceptable with the implementation of appropriate BMPs.

- Lock water tank valves to prevent unauthorized use.

Costs
The cost is small to none compared to the benefits of conserving water.

Inspection and Maintenance
- Inspect and verify that activity based BMPs are in place prior to the commencement of authorized non-stormwater discharges.

- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges are occuring.

- Repair water equipment as needed to prevent unintended discharges.

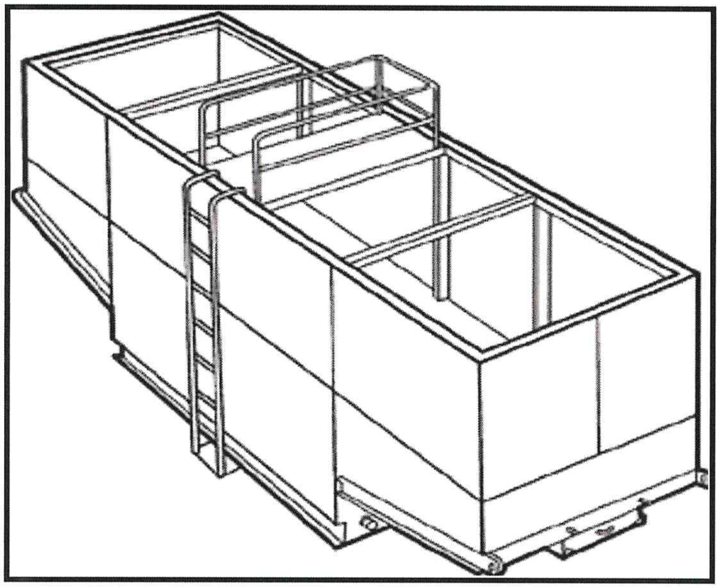
  - Water trucks

  - Water reservoirs (water buffalos)

  - Irrigation systems

  - Hydrant connections

References
Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.



Categories

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Legend:

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☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

SE-5: Fiber Roll

SE-6: Gravel Bag Berm

Description and Purpose

Dewatering operations are practices that manage the discharge of pollutants when non-stormwater and accumulated precipitation (stormwater) must be removed from a work location to proceed with construction work or to provide vector control.

The General Permit incorporates Numeric Effluent Limits (NEL) and Numeric Action Levels (NAL) for turbidity (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Discharges from dewatering operations can contain high levels of fine sediment and other pollutants that, if not properly treated, could lead to exceedences of the General Permit requirements or Basin Plan standards.

Suitable Applications

These practices are implemented for discharges of non-stormwater from construction sites. Non-stormwaters include, but are not limited to, groundwater, water from cofferdams, water diversions, and waters used during construction activities that must be removed from a work area to facilitate construction.

Practices identified in this section are also appropriate for implementation when managing the removal of accumulated precipitation (stormwater) from depressed areas at a construction site.

Stormwater mixed with non-stormwater should be managed as non-stormwater.

Limitations

- Dewatering operations will require, and should comply with applicable local and project-specific permits and regulations. In some areas, all dewatering activities, regardless of the discharge volume, require a dewatering permit.
- Site conditions will dictate design and use of dewatering operations.
- The controls discussed in this fact sheet primarily address sediment. Other secondary pollutant removal benefits are discussed where applicable.
- The controls detailed in this fact sheet only allow for minimal settling time for sediment particles. Use only when site conditions restrict the use of the other control methods.
- Avoid dewatering discharges where possible by using the water for dust control.

Implementation

- A Construction Site Monitoring Plan (CSMP) should be included in the project Stormwater Pollution Prevention Plan (SWPPP).
- Regional Water Quality Control Board (RWQCB) Regions may require notification and approval prior to any discharge of water from construction sites.
- The destination of discharge from dewatering activities will typically determine the type of permit required by the discharger. For example, when discharging to a water of the U.S., a dewatering permit may be required from the site's governing RWQCB. When discharging to a sanitary sewer or Municipal Separate Storm Sewer System (MS4), a permit may need to be obtained through the owner of the sanitary sewer or MS4 in addition to obtaining an RWQCB dewatering permit. Additional permits or permissions from other agencies may be required for dewatering cofferdams or diversions.
- Dewatering discharges should not cause erosion at the discharge point. Appropriate BMPs should be implemented to maintain compliance with all applicable permits.
- Maintain dewatering records in accordance with all local and project-specific permits and regulations.

Sediment Treatment

A variety of methods can be used to treat water during dewatering operations. Several devices are presented below and provide options to achieve sediment removal. The sediment particle size and permit or receiving water limitations on sediment or turbidity are key considerations for selecting sediment treatment option(s); in some cases, the use of multiple devices may be appropriate. Use of other enhanced treatment methods (i.e., introduction of chemicals or electric current to enhance flocculation and removal of sediment) must comply with: 1) for storm drain or surface water discharges, the requirements for Active Treatment Systems (see SE-11); or 2) for sanitary sewer discharges, the requirements of applicable sanitary sewer discharge permits.

Sediment Basin (see also SE-2)

Description:

- A sediment basin is a temporary basin with a controlled release structure that is formed by excavation or construction of an embankment to detain sediment-laden runoff and allow sediment to settle out before discharging. Sediment basins are generally larger than Sediment Traps (SE-3) and have a designed outlet structure.

Appropriate Applications:

- Effective for the removal of trash, gravel, sand, silt, some metals that settle out with the sediment.

Implementation:

- Excavation and construction of related facilities is required.
- Temporary sediment basins should be fenced if safety is a concern.
- Outlet protection is required to prevent erosion at the outfall location.

Maintenance:

- Maintenance is required for safety fencing, vegetation, embankment, inlet and outlet, as well as other features.
- Removal of sediment is required when the storage volume is reduced by one-third.

Sediment Trap (See also SE-3)

Description:

- A sediment trap is a temporary basin formed by excavation and/or construction of an earthen embankment across a waterway or low drainage area to detain sediment-laden runoff and allow sediment to settle out before discharging. Sediment traps are generally smaller than Sediment Basins (SE-2) and do not have a designed outlet (but do have a spillway or overflow).

Appropriate Applications:

Effective for the removal of large and medium sized particles (sand and gravel) and some metals that settle out with the sediment.

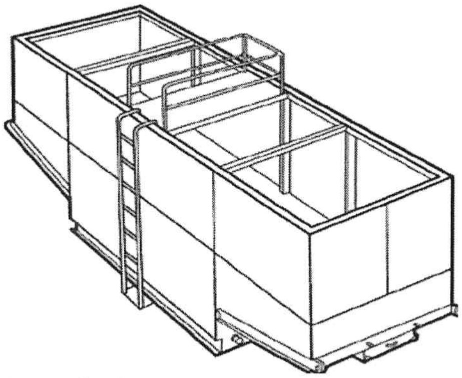
Implementation:

- Excavation and construction of related facilities is required.
- Trap inlets should be located to maximize the travel distance to the trap outlet.
- Use rock or vegetation to protect the trap outlets against erosion.

Maintenance:

- Maintenance is required for vegetation, embankment, inlet and outfall structures, as well as other features.
- Removal of sediment is required when the storage volume is reduced by one-third.

Weir Tanks



Description:

- A weir tank separates water and waste by using weirs. The configuration of the weirs (over and under weirs) maximizes the residence time in the tank and determines the waste to be removed from the water, such as oil, grease, and sediments.

Appropriate Applications:

- The tank removes trash, some settleable solids (gravel, sand, and silt), some visible oil and grease, and some metals (removed with sediment). To achieve high levels of flow, multiple tanks can be used in parallel. If additional treatment is desired, the tanks can be placed in series or as pre-treatment for other methods.

Implementation:

- Tanks are delivered to the site by the vendor, who can provide assistance with set-up and operation.

- Tank size will depend on flow volume, constituents of concern, and residency period required. Vendors should be consulted to appropriately size tank.

- Treatment capacity (i.e., volume and number of tanks) should provide at a minimum the required volume for discrete particle settling for treatment design flows.

Maintenance:

- Periodic cleaning is required based on visual inspection or reduced flow.

- Oil and grease disposal should be conducted by a licensed waste disposal company.

Dewatering Tanks

Description:

- A dewatering tank removes debris and sediment. Flow enters the tank through the top, passes through a fabric filter, and is discharged through the bottom of the tank. The filter separates the solids from the liquids.

Appropriate Applications:

- The tank removes trash, gravel, sand, and silt, some visible oil and grease, and some metals (removed with sediment). To achieve high levels of flow, multiple tanks can be used in parallel. If additional treatment is desired, the tanks can be placed in series or as pre-treatment for other methods.

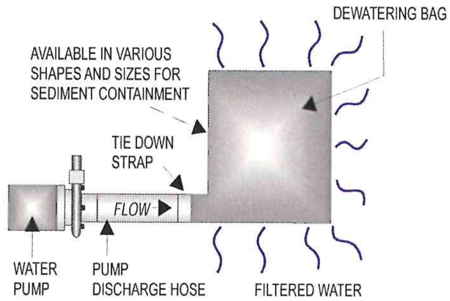
Implementation:

- Tanks are delivered to the site by the vendor, who can provide assistance with set-up and operation.
- Tank size will depend on flow volume, constituents of concern, and residency period required. Vendors should be consulted to appropriately size tank.

Maintenance:

- Periodic cleaning is required based on visual inspection or reduced flow.
- Oil and grease disposal should be conducted by licensed waste disposal company.

Gravity Bag Filter



Description:

- A gravity bag filter, also referred to as a dewatering bag, is a square or rectangular bag made of non-woven geotextile fabric that collects gravel, sand, silt, and fines.

Appropriate Applications:

- Effective for the removal of sediments (gravel, sand, silt, and fines). Some metals are removed with the sediment.

Implementation:

- Water is pumped into one side of the bag and seeps through the top, bottom, and sides of the bag.
- Place filter bag on pavement or a gravel bed or paved surface. Avoid placing a dewatering bag on unprotected bare soil. If placing the bag on bare soil is unavoidable, a secondary barrier should be used, such as a rock filter bed placed beneath and beyond the edges of the bag to, prevent erosion and capture sediments that escape the bag.
- Perimeter control around the downstream end of the bag should be implemented. Secondary sediment controls are important especially in the initial stages of discharge, which tend to allow fines to pass through the bag.

Maintenance:

- Inspection of the flow conditions, bag condition, bag capacity, and the secondary barrier (as applicable) is required.
- Replace the bag when it no longer filters sediment or passes water at a reasonable rate.
- Caution should be taken when removing and disposing of the bag, to prevent the release of captured sediment
- Properly dispose of the bag offsite. If sediment is removed from the bag prior to disposal (bags can potentially be reused depending upon their condition), dispose of sediment in accordance with the general maintenance procedures described at the end of this BMP Fact Sheet.

Sand Media Particulate Filter

Description:

- Water is treated by passing it through canisters filled with sand media. Generally, sand filters provide a final level of treatment. They are often used as a secondary or higher level of treatment after a significant amount of sediment and other pollutants have been removed using other methods.

Appropriate Applications:

- Effective for the removal of trash, gravel, sand, and silt and some metals, as well as the reduction of biochemical oxygen demand (BOD) and turbidity.
- Sand filters can be used for stand-alone treatment or in conjunction with bag and cartridge filtration if further treatment is required.
- Sand filters can also be used to provide additional treatment to water treated via settling or basic filtration.

Implementation:

- The filters require delivery to the site and initial set up. The vendor can provide assistance with installation and operation.

Maintenance:

- The filters require regular service to monitor and maintain the level of the sand media. If subjected to high loading rates, filters can plug quickly.
- Venders generally provide data on maximum head loss through the filter. The filter should be monitored daily while in use, and cleaned when head loss reaches target levels.
- If cleaned by backwashing, the backwash water may need to be hauled away for disposal, or returned to the upper end of the treatment train for another pass through the series of dewatering BMPs.

Pressurized Bag Filter

Pressurized Bag Filter

Description:

- A pressurized bag filter is a unit composed of single filter bags made from polyester felt material. The water filters through the unit and is discharged through a header. Vendors provide bag filters in a variety of configurations. Some units include a combination of bag filters and cartridge filters for enhanced contaminant removal.

Appropriate Applications:

- Effective for the removal of sediment (sand and silt) and some metals, as well as the reduction of BOD, turbidity, and hydrocarbons. Oil absorbent bags are available for hydrocarbon removal.

- Filters can be used to provide secondary treatment to water treated via settling or basic filtration.

Implementation:

- The filters require delivery to the site and initial set up. The vendor can provide assistance with installation and operation.

Maintenance:

- The filter bags require replacement when the pressure differential equals or exceeds the manufacturer's recommendation.

Cartridge Filter

Description:

- Cartridge filters provide a high degree of pollutant removal by utilizing a number of individual cartridges as part of a larger filtering unit. They are often used as a secondary or higher (polishing) level of treatment after a significant amount of sediment and other pollutants are removed. Units come with various cartridge configurations (for use in series with bag filters) or with a larger single cartridge filtration unit (with multiple filters within).

Appropriate Applications:

- Effective for the removal of sediment (sand, silt, and some clays) and metals, as well as the reduction of BOD, turbidity, and hydrocarbons. Hydrocarbons can effectively be removed with special resin cartridges.

- Filters can be used to provide secondary treatment to water treated via settling or basic filtration.

Implementation:

- The filters require delivery to the site and initial set up. The vendor can provide assistance.

Maintenance:

- The cartridges require replacement when the pressure differential equals or exceeds the manufacturer's recommendation.

Costs

- Sediment control costs vary considerably depending on the dewatering and sediment treatment system that is selected. Pressurized filters tend to be more expensive than gravity settling, but are often more effective. Simple tanks are generally rented on a long-term basis (one or more months) and can range from $360 per month for a 1,000 gallon tank to $2,660 per month for a 10,000 gallon tank. Mobilization and demobilization costs vary considerably.

Inspection and Maintenance

- Inspect and verify that dewatering BMPs are in place and functioning prior to the commencement of activities requiring dewatering.

- Inspect dewatering BMPs daily while dewatering activities are being conducted.

- Inspect all equipment before use. Monitor dewatering operations to ensure they do not cause offsite discharge or erosion.
- Sample dewatering discharges as required by the General Permit.
- Unit-specific maintenance requirements are included with the description of each unit.
- Sediment removed during the maintenance of a dewatering device may be either spread onsite and stabilized, or disposed of at a disposal site as approved by the owner.
- Sediment that is commingled with other pollutants should be disposed of in accordance with all applicable laws and regulations and as approved by the owner.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

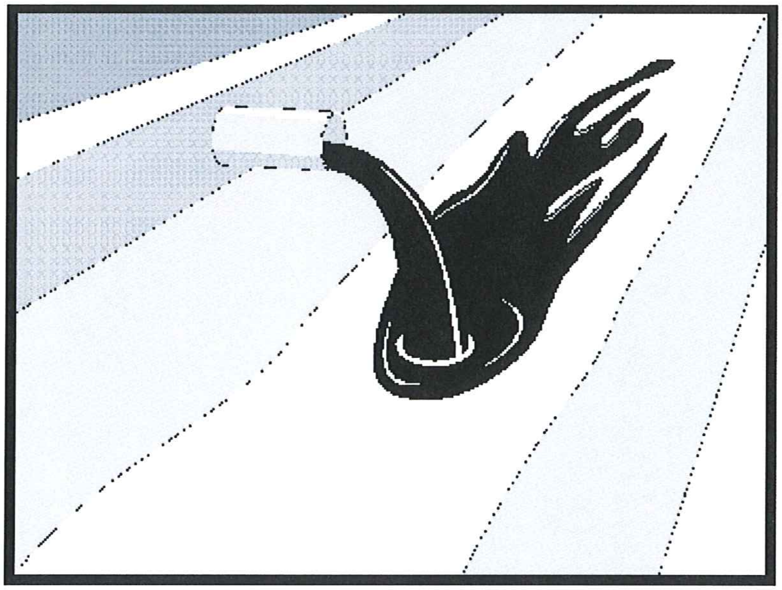
Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003; Updated March 2004.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Labor Surcharge & Equipment Rental Rates, April 1, 2002 through March 31, 2003, California Department of Transportation (Caltrans).

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Illicit Connection/Discharge NS-6



Categories

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Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Procedures and practices designed for construction contractors to recognize illicit connections or illegally dumped or discharged materials on a construction site and report incidents.

Suitable Applications

This best management practice (BMP) applies to all construction projects. Illicit connection/discharge and reporting is applicable anytime an illicit connection or discharge is discovered or illegally dumped material is found on the construction site.

Limitations

Illicit connections and illegal discharges or dumping, for the purposes of this BMP, refer to discharges and dumping caused by parties other than the contractor. If pre-existing hazardous materials or wastes are known to exist onsite, they should be identified in the SWPPP and handled as set forth in the SWPPP.

Implementation

Planning

- Review the SWPPP. Pre-existing areas of contamination should be identified and documented in the SWPPP.

- Inspect site before beginning the job for evidence of illicit connections, illegal dumping or discharges. Document any pre-existing conditions and notify the owner.

- Inspect site regularly during project execution for evidence

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of illicit connections, illegal dumping or discharges.

- Observe site perimeter for evidence for potential of illicitly discharged or illegally dumped material, which may enter the job site.

Identification of Illicit Connections and Illegal Dumping or Discharges

- **General** – unlabeled and unidentifiable material should be treated as hazardous.

- **Solids** - Look for debris, or rubbish piles. Solid waste dumping often occurs on roadways with light traffic loads or in areas not easily visible from the traveled way.

- **Liquids** - signs of illegal liquid dumping or discharge can include:

  - Visible signs of staining or unusual colors to the pavement or surrounding adjacent soils
  - Pungent odors coming from the drainage systems
  - Discoloration or oily substances in the water or stains and residues detained within ditches, channels or drain boxes
  - Abnormal water flow during the dry weather season

- **Urban Areas** - Evidence of illicit connections or illegal discharges is typically detected at storm drain outfall locations or at manholes. Signs of an illicit connection or illegal discharge can include:

  - Abnormal water flow during the dry weather season
  - Unusual flows in sub drain systems used for dewatering
  - Pungent odors coming from the drainage systems
  - Discoloration or oily substances in the water or stains and residues detained within ditches, channels or drain boxes
  - Excessive sediment deposits, particularly adjacent to or near active offsite construction projects

- **Rural Areas** - Illicit connections or illegal discharges involving irrigation drainage ditches are detected by visual inspections. Signs of an illicit discharge can include:

  - Abnormal water flow during the non-irrigation season
  - Non-standard junction structures
  - Broken concrete or other disturbances at or near junction structures

Reporting

Notify the owner of any illicit connections and illegal dumping or discharge incidents at the time of discovery. For illicit connections or discharges to the storm drain system, notify the local stormwater management agency. For illegal dumping, notify the local law enforcement agency.

Cleanup and Removal

The responsibility for cleanup and removal of illicit or illegal dumping or discharges will vary by location. Contact the local stormwater management agency for further information.

Costs

Costs to look for and report illicit connections and illegal discharges and dumping are low. The best way to avoid costs associated with illicit connections and illegal discharges and dumping is to keep the project perimeters secure to prevent access to the site, to observe the site for vehicles that should not be there, and to document any waste or hazardous materials that exist onsite before taking possession of the site.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.

- Inspect the site regularly to check for any illegal dumping or discharge.

- Prohibit employees and subcontractors from disposing of non-job related debris or materials at the construction site.

- Notify the owner of any illicit connections and illegal dumping or discharge incidents at the time of discovery.

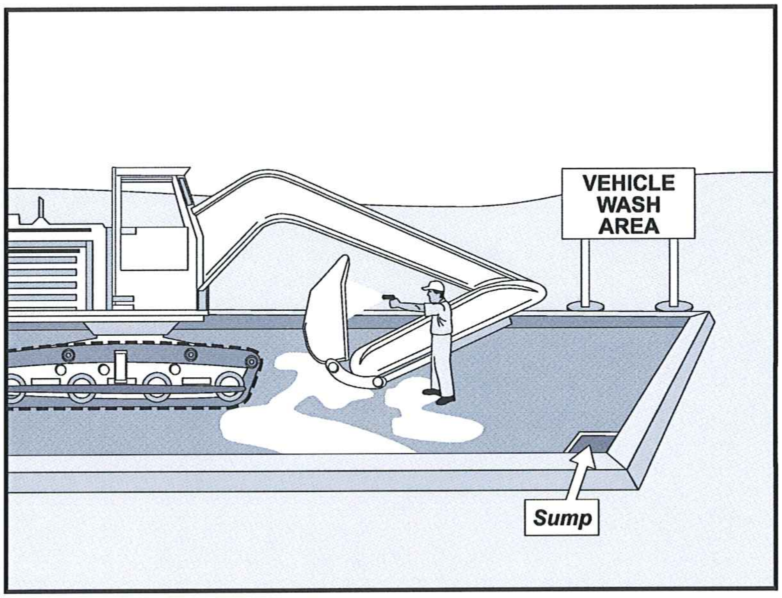
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Vehicle and Equipment Cleaning NS-8



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Vehicle and equipment cleaning procedures and practices eliminate or reduce the discharge of pollutants to stormwater from vehicle and equipment cleaning operations. Procedures and practices include but are not limited to: using offsite facilities; washing in designated, contained areas only; eliminating discharges to the storm drain by infiltrating the wash water; and training employees and subcontractors in proper cleaning procedures.

Suitable Applications

These procedures are suitable on all construction sites where vehicle and equipment cleaning is performed.

Limitations

Even phosphate-free, biodegradable soaps have been shown to be toxic to fish before the soap degrades. Sending vehicles/equipment offsite should be done in conjunction with TC-1, Stabilized Construction Entrance/Exit.

Implementation

Other options to washing equipment onsite include contracting with either an offsite or mobile commercial washing business. These businesses may be better equipped to handle and dispose of the wash waters properly. Performing this work offsite can also be economical by eliminating the need for a separate washing operation onsite.

If washing operations are to take place onsite, then:

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- Use phosphate-free, biodegradable soaps.
- Educate employees and subcontractors on pollution prevention measures.
- Do not permit steam cleaning onsite. Steam cleaning can generate significant pollutant concentrates.
- Cleaning of vehicles and equipment with soap, solvents or steam should not occur on the project site unless resulting wastes are fully contained and disposed of. Resulting wastes should not be discharged or buried, and must be captured and recycled or disposed according to the requirements of WM-10, Liquid Waste Management or WM-6, Hazardous Waste Management, depending on the waste characteristics. Minimize use of solvents. Use of diesel for vehicle and equipment cleaning is prohibited.
- All vehicles and equipment that regularly enter and leave the construction site must be cleaned offsite.
- When vehicle and equipment washing and cleaning must occur onsite, and the operation cannot be located within a structure or building equipped with appropriate disposal facilities, the outside cleaning area should have the following characteristics:
  - Located away from storm drain inlets, drainage facilities, or watercourses
  - Paved with concrete or asphalt and bermed to contain wash waters and to prevent runon and runoff
  - Configured with a sump to allow collection and disposal of wash water
  - No discharge of wash waters to storm drains or watercourses
  - Used only when necessary
- When cleaning vehicles and equipment with water:
  - Use as little water as possible. High-pressure sprayers may use less water than a hose and should be considered
  - Use positive shutoff valve to minimize water usage
  - Facility wash racks should discharge to a sanitary sewer, recycle system or other approved discharge system and must not discharge to the storm drainage system, watercourses, or to groundwater

Costs

Cleaning vehicles and equipment at an offsite facility may reduce overall costs for vehicle and equipment cleaning by eliminating the need to provide similar services onsite. When onsite cleaning is needed, the cost to establish appropriate facilities is relatively low on larger, long-duration projects, and moderate to high on small, short-duration projects.

Inspection and Maintenance

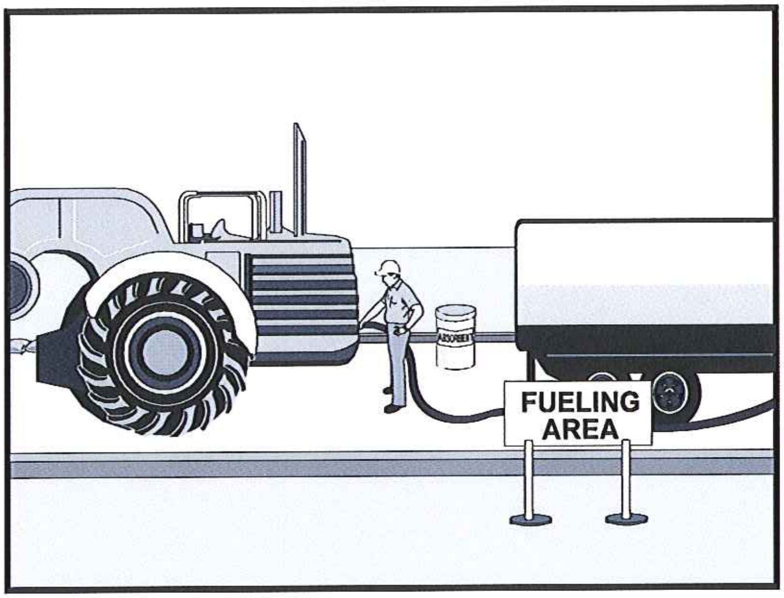
- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspection and maintenance is minimal, although some berm repair may be necessary.
- Monitor employees and subcontractors throughout the duration of the construction project to ensure appropriate practices are being implemented.
- Inspect sump regularly and remove liquids and sediment as needed.
- Prohibit employees and subcontractors from washing personal vehicles and equipment on the construction site.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Swisher, R.D. Surfactant Biodegradation, Marcel Decker Corporation, 1987.

Vehicle and Equipment Fueling



Categories

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NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

Vehicle equipment fueling procedures and practices are designed to prevent fuel spills and leaks, and reduce or eliminate contamination of stormwater. This can be accomplished by using offsite facilities, fueling in designated areas only, enclosing or covering stored fuel, implementing spill controls, and training employees and subcontractors in proper fueling procedures.

Suitable Applications

These procedures are suitable on all construction sites where vehicle and equipment fueling takes place.

Limitations

Onsite vehicle and equipment fueling should only be used where it is impractical to send vehicles and equipment offsite for fueling. Sending vehicles and equipment offsite should be done in conjunction with TC-1, Stabilized Construction Entrance/ Exit.

Implementation

- Use offsite fueling stations as much as possible. These businesses are better equipped to handle fuel and spills properly. Performing this work offsite can also be economical by eliminating the need for a separate fueling area at a site.
- Discourage "topping-off" of fuel tanks.
- Absorbent spill cleanup materials and spill kits should be available in fueling areas and on fueling trucks, and should

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be disposed of properly after use.

- Drip pans or absorbent pads should be used during vehicle and equipment fueling, unless the fueling is performed over an impermeable surface in a dedicated fueling area.

- Use absorbent materials on small spills. Do not hose down or bury the spill. Remove the adsorbent materials promptly and dispose of properly.

- Avoid mobile fueling of mobile construction equipment around the site; rather, transport the equipment to designated fueling areas. With the exception of tracked equipment such as bulldozers and large excavators, most vehicles should be able to travel to a designated area with little lost time.

- Train employees and subcontractors in proper fueling and cleanup procedures.

- When fueling must take place onsite, designate an area away from drainage courses to be used. Fueling areas should be identified in the SWPPP.

- Dedicated fueling areas should be protected from stormwater runon and runoff, and should be located at least 50 ft away from downstream drainage facilities and watercourses. Fueling must be performed on level-grade areas.

- Protect fueling areas with berms and dikes to prevent runon, runoff, and to contain spills.

- Nozzles used in vehicle and equipment fueling should be equipped with an automatic shutoff to control drips. Fueling operations should not be left unattended.

- Use vapor recovery nozzles to help control drips as well as air pollution where required by Air Quality Management Districts (AQMD).

- Federal, state, and local requirements should be observed for any stationary above ground storage tanks.

Costs

- All of the above measures are low cost except for the capital costs of above ground tanks that meet all local environmental, zoning, and fire codes.

Inspection and Maintenance

- Vehicles and equipment should be inspected each day of use for leaks. Leaks should be repaired immediately or problem vehicles or equipment should be removed from the project site.

- Keep ample supplies of spill cleanup materials onsite.

- Immediately clean up spills and properly dispose of contaminated soil and cleanup materials.

References

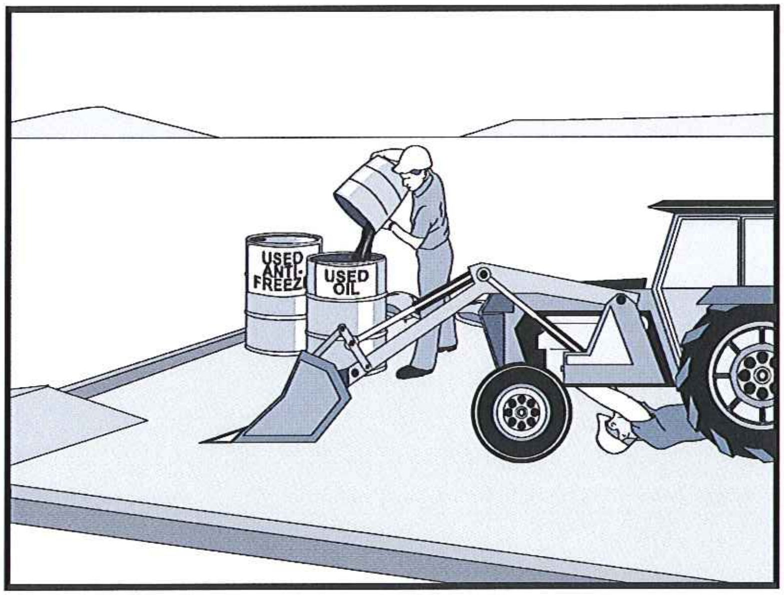
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Vehicle & Equipment Maintenance NS-10



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Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents	
Sediment	
Nutrients	☑
Trash	☑
Metals	
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Prevent or reduce the contamination of stormwater resulting from vehicle and equipment maintenance by running a "dry and clean site". The best option would be to perform maintenance activities at an offsite facility. If this option is not available then work should be performed in designated areas only, while providing cover for materials stored outside, checking for leaks and spills, and containing and cleaning up spills immediately. Employees and subcontractors must be trained in proper procedures.

Suitable Applications

These procedures are suitable on all construction projects where an onsite yard area is necessary for storage and maintenance of heavy equipment and vehicles.

Limitations

Onsite vehicle and equipment maintenance should only be used where it is impractical to send vehicles and equipment offsite for maintenance and repair. Sending vehicles/equipment offsite should be done in conjunction with TC-1, Stabilized Construction Entrance/Exit.

Outdoor vehicle or equipment maintenance is a potentially significant source of stormwater pollution. Activities that can contaminate stormwater include engine repair and service, changing or replacement of fluids, and outdoor equipment storage and parking (engine fluid leaks). For further information on vehicle or equipment servicing, see NS-8, Vehicle and Equipment Cleaning, and NS-9, Vehicle and

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Equipment Fueling.

Implementation

- Use offsite repair shops as much as possible. These businesses are better equipped to handle vehicle fluids and spills properly. Performing this work offsite can also be economical by eliminating the need for a separate maintenance area.
- If maintenance must occur onsite, use designated areas, located away from drainage courses. Dedicated maintenance areas should be protected from stormwater runon and runoff, and should be located at least 50 ft from downstream drainage facilities and watercourses.
- Drip pans or absorbent pads should be used during vehicle and equipment maintenance work that involves fluids, unless the maintenance work is performed over an impermeable surface in a dedicated maintenance area.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- All fueling trucks and fueling areas are required to have spill kits and/or use other spill protection devices.
- Use adsorbent materials on small spills. Remove the absorbent materials promptly and dispose of properly.
- Inspect onsite vehicles and equipment daily at startup for leaks, and repair immediately.
- Keep vehicles and equipment clean; do not allow excessive build-up of oil and grease.
- Segregate and recycle wastes, such as greases, used oil or oil filters, antifreeze, cleaning solutions, automotive batteries, hydraulic and transmission fluids. Provide secondary containment and covers for these materials if stored onsite.
- Train employees and subcontractors in proper maintenance and spill cleanup procedures.
- Drip pans or plastic sheeting should be placed under all vehicles and equipment placed on docks, barges, or other structures over water bodies when the vehicle or equipment is planned to be idle for more than 1 hour.
- For long-term projects, consider using portable tents or covers over maintenance areas if maintenance cannot be performed offsite.
- Consider use of new, alternative greases and lubricants, such as adhesive greases, for chassis lubrication and fifth-wheel lubrication.
- Properly dispose of used oils, fluids, lubricants, and spill cleanup materials.
- Do not place used oil in a dumpster or pour into a storm drain or watercourse.
- Properly dispose of or recycle used batteries.
- Do not bury used tires.

- Repair leaks of fluids and oil immediately.

Listed below is further information if you must perform vehicle or equipment maintenance onsite.

Safer Alternative Products

- Consider products that are less toxic or hazardous than regular products. These products are often sold under an "environmentally friendly" label.
- Consider use of grease substitutes for lubrication of truck fifth-wheels. Follow manufacturers label for details on specific uses.
- Consider use of plastic friction plates on truck fifth-wheels in lieu of grease. Follow manufacturers label for details on specific uses.

Waste Reduction

Parts are often cleaned using solvents such as trichloroethylene, trichloroethane, or methylene chloride. Many of these cleaners are listed in California Toxic Rule as priority pollutants. These materials are harmful and must not contaminate stormwater. They must be disposed of as a hazardous waste. Reducing the number of solvents makes recycling easier and reduces hazardous waste management costs. Often, one solvent can perform a job as well as two different solvents. Also, if possible, eliminate or reduce the amount of hazardous materials and waste by substituting non-hazardous or less hazardous materials. For example, replace chlorinated organic solvents with non-chlorinated solvents. Non-chlorinated solvents like kerosene or mineral spirits are less toxic and less expensive to dispose of properly. Check the list of active ingredients to see whether it contains chlorinated solvents. The "chlor" term indicates that the solvent is chlorinated. Also, try substituting a wire brush for solvents to clean parts.

Recycling and Disposal

Separating wastes allows for easier recycling and may reduce disposal costs. Keep hazardous wastes separate, do not mix used oil solvents, and keep chlorinated solvents (like,-trichloroethane) separate from non-chlorinated solvents (like kerosene and mineral spirits). Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around. Provide cover and secondary containment until these materials can be removed from the site.

Oil filters can be recycled. Ask your oil supplier or recycler about recycling oil filters.

Do not dispose of extra paints and coatings by dumping liquid onto the ground or throwing it into dumpsters. Allow coatings to dry or harden before disposal into covered dumpsters.

Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Costs

All of the above are low cost measures. Higher costs are incurred to setup and maintain onsite maintenance areas.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.

- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.

- Keep ample supplies of spill cleanup materials onsite.

- Maintain waste fluid containers in leak proof condition.

- Vehicles and equipment should be inspected on each day of use. Leaks should be repaired immediately or the problem vehicle(s) or equipment should be removed from the project site.

- Inspect equipment for damaged hoses and leaky gaskets routinely. Repair or replace as needed.

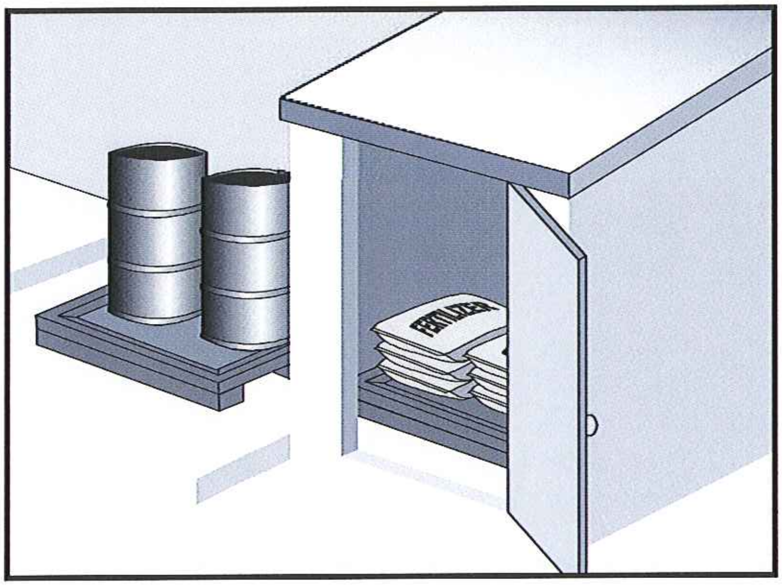
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program; Program Development and Approval Guidance, Working Group, Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Material Delivery and Storage WM-1



Categories

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SE	Sediment Control	
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Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Prevent, reduce, or eliminate the discharge of pollutants from material delivery and storage to the stormwater system or watercourses by minimizing the storage of hazardous materials onsite, storing materials in watertight containers and/or a completely enclosed designated area, installing secondary containment, conducting regular inspections, and training employees and subcontractors.

This best management practice covers only material delivery and storage. For other information on materials, see WM-2, Material Use, or WM-4, Spill Prevention and Control. For information on wastes, see the waste management BMPs in this section.

Suitable Applications

These procedures are suitable for use at all construction sites with delivery and storage of the following materials:

- Soil stabilizers and binders
- Pesticides and herbicides
- Fertilizers
- Detergents
- Plaster
- Petroleum products such as fuel, oil, and grease

- Asphalt and concrete components
- Hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds
- Concrete compounds
- Other materials that may be detrimental if released to the environment

Limitations

- Space limitation may preclude indoor storage.
- Storage sheds often must meet building and fire code requirements.

Implementation

The following steps should be taken to minimize risk:

- Chemicals must be stored in water tight containers with appropriate secondary containment or in a storage shed.
- When a material storage area is located on bare soil, the area should be lined and bermed.
- Use containment pallets or other practical and available solutions, such as storing materials within newly constructed buildings or garages, to meet material storage requirements.
- Stack erodible landscape material on pallets and cover when not in use.
- Contain all fertilizers and other landscape materials when not in use.
- Temporary storage areas should be located away from vehicular traffic.
- Material Safety Data Sheets (MSDS) should be available on-site for all materials stored that have the potential to effect water quality.
- Construction site areas should be designated for material delivery and storage.
- Material delivery and storage areas should be located away from waterways, if possible.
  - Avoid transport near drainage paths or waterways.
  - Surround with earth berms or other appropriate containment BMP. See EC-9, Earth Dikes and Drainage Swales.
  - Place in an area that will be paved.
- Storage of reactive, ignitable, or flammable liquids must comply with the fire codes of your area. Contact the local Fire Marshal to review site materials, quantities, and proposed storage area to determine specific requirements. See the Flammable and Combustible Liquid Code, NFPA30.
- An up to date inventory of materials delivered and stored onsite should be kept.

- Hazardous materials storage onsite should be minimized.
- Hazardous materials should be handled as infrequently as possible.
- Keep ample spill cleanup supplies appropriate for the materials being stored. Ensure that cleanup supplies are in a conspicuous, labeled area.
- Employees and subcontractors should be trained on the proper material delivery and storage practices.
- Employees trained in emergency spill cleanup procedures must be present when dangerous materials or liquid chemicals are unloaded.
- If significant residual materials remain on the ground after construction is complete, properly remove and dispose of materials and any contaminated soil. See WM-7, Contaminated Soil Management. If the area is to be paved, pave as soon as materials are removed to stabilize the soil.

Material Storage Areas and Practices

- Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 should be stored in approved containers and drums and should not be overfilled. Containers and drums should be placed in temporary containment facilities for storage.
- A temporary containment facility should provide for a spill containment volume able to contain precipitation from a 25 year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest container within its boundary, whichever is greater.
- A temporary containment facility should be impervious to the materials stored therein for a minimum contact time of 72 hours.
- A temporary containment facility should be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills should be collected and placed into drums. These liquids should be handled as a hazardous waste unless testing determines them to be non-hazardous. All collected liquids or non-hazardous liquids should be sent to an approved disposal site.
- Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.
- Incompatible materials, such as chlorine and ammonia, should not be stored in the same temporary containment facility.
- Materials should be covered prior to, and during rain events.
- Materials should be stored in their original containers and the original product labels should be maintained in place in a legible condition. Damaged or otherwise illegible labels should be replaced immediately.

- Bagged and boxed materials should be stored on pallets and should not be allowed to accumulate on the ground. To provide protection from wind and rain throughout the rainy season, bagged and boxed materials should be covered during non-working days and prior to and during rain events.
- Stockpiles should be protected in accordance with WM-3, Stockpile Management.
- Materials should be stored indoors within existing structures or completely enclosed storage sheds when available.
- Proper storage instructions should be posted at all times in an open and conspicuous location.
- An ample supply of appropriate spill clean up material should be kept near storage areas.
- Also see WM-6, Hazardous Waste Management, for storing of hazardous wastes.

Material Delivery Practices

- Keep an accurate, up-to-date inventory of material delivered and stored onsite.
- Arrange for employees trained in emergency spill cleanup procedures to be present when dangerous materials or liquid chemicals are unloaded.

Spill Cleanup

- Contain and clean up any spill immediately.
- Properly remove and dispose of any hazardous materials or contaminated soil if significant residual materials remain on the ground after construction is complete. See WM-7, Contaminated Soil Management.
- See WM-4, Spill Prevention and Control, for spills of chemicals and/or hazardous materials.
- If spills or leaks of materials occur that are not contained and could discharge to surface waters, non-visible sampling of site discharge may be required. Refer to the General Permit or to your project specific Construction Site Monitoring Plan to determine if and where sampling is required.

Cost

- The largest cost of implementation may be in the construction of a materials storage area that is covered and provides secondary containment.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Keep storage areas clean and well organized, including a current list of all materials onsite.
- Inspect labels on containers for legibility and accuracy.

- Repair or replace perimeter controls, containment structures, covers, and liners as needed to maintain proper function.

References

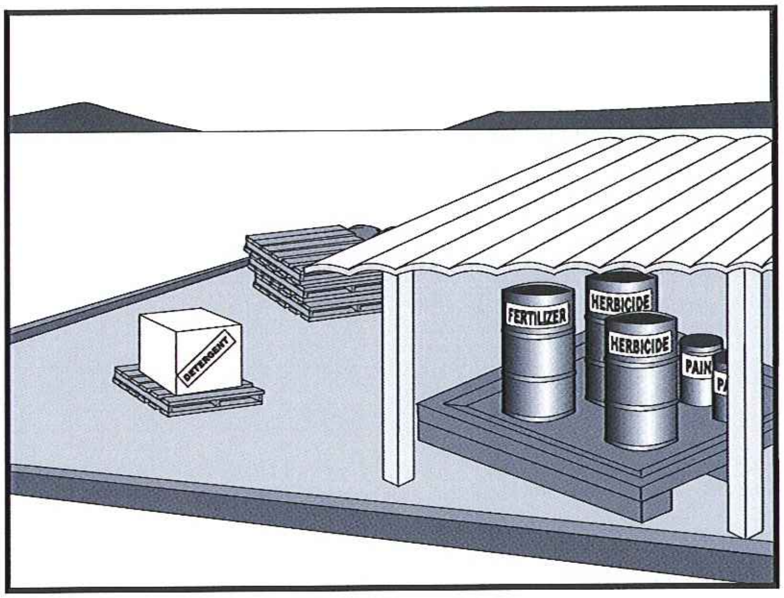
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Material Use



Categories

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☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Prevent or reduce the discharge of pollutants to the storm drain system or watercourses from material use by using alternative products, minimizing hazardous material use onsite, and training employees and subcontractors.

Suitable Applications

This BMP is suitable for use at all construction projects. These procedures apply when the following materials are used or prepared onsite:

- Pesticides and herbicides
- Fertilizers
- Detergents
- Petroleum products such as fuel, oil, and grease
- Asphalt and other concrete components
- Other hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds
- Other materials that may be detrimental if released to the environment

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Limitations
Safer alternative building and construction products may not be available or suitable in every instance.

Implementation
The following steps should be taken to minimize risk:

- Minimize use of hazardous materials onsite.
- Follow manufacturer instructions regarding uses, protective equipment, ventilation, flammability, and mixing of chemicals.
- Train personnel who use pesticides. The California Department of Pesticide Regulation and county agricultural commissioners license pesticide dealers, certify pesticide applicators, and conduct onsite inspections.
- The preferred method of termiticide application is soil injection near the existing or proposed structure foundation/slab; however, if not feasible, soil drench application of termiticides should follow EPA label guidelines and the following recommendations (most of which are applicable to most pesticide applications):
  - Do not treat soil that is water-saturated or frozen.
  - Application shall not commence within 24-hours of a predicted precipitation event with a 40% or greater probability. Weather tracking must be performed on a daily basis prior to termiticide application and during the period of termiticide application.
  - Do not allow treatment chemicals to runoff from the target area. Apply proper quantity to prevent excess runoff. Provide containment for and divert stormwater from application areas using berms or diversion ditches during application.
  - Dry season: Do not apply within 10 feet of storm drains. Do not apply within 25 feet of aquatic habitats (such as, but not limited to, lakes; reservoirs; rivers; permanent streams; marshes or ponds; estuaries; and commercial fish farm ponds).
  - Wet season: Do not apply within 50 feet of storm drains or aquatic habitats (such as, but not limited to, lakes; reservoirs; rivers; permanent streams; marshes or ponds; estuaries; and commercial fish farm ponds) unless a vegetative buffer is present (if so, refer to dry season requirements).
  - Do not make on-grade applications when sustained wind speeds are above 10 mph (at application site) at nozzle end height.
  - Cover treatment site prior to a rain event in order to prevent run-off of the pesticide into non-target areas. The treated area should be limited to a size that can be backfilled and/or covered by the end of the work shift. Backfilling or covering of the treated area shall be done by the end of the same work shift in which the application is made.
  - The applicator must either cover the soil him/herself or provide written notification of the above requirement to the contractor on site and to the person commissioning the

application (if different than the contractor). If notice is provided to the contractor or the person commissioning the application, then they are responsible under the Federal Insecticide Fungicide, and Rodenticide Act (FIFRA) to ensure that: 1) if the concrete slab cannot be poured over the treated soil within 24 hours of application, the treated soil is covered with a waterproof covering (such as polyethylene sheeting), and 2) the treated soil is covered if precipitation is predicted to occur before the concrete slab is scheduled to be poured.

- Do not over-apply fertilizers, herbicides, and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over-application is expensive and environmentally harmful. Unless on steep slopes, till fertilizers into the soil rather than hydraulic application. Apply surface dressings in several smaller applications, as opposed to one large application, to allow time for infiltration and to avoid excess material being carried offsite by runoff. Do not apply these chemicals before predicted rainfall.
- Train employees and subcontractors in proper material use.
- Supply Material Safety Data Sheets (MSDS) for all materials.
- Dispose of latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths, when thoroughly dry and are no longer hazardous, with other construction debris.
- Do not remove the original product label; it contains important safety and disposal information. Use the entire product before disposing of the container.
- Mix paint indoors or in a containment area. Never clean paintbrushes or rinse paint containers into a street, gutter, storm drain, or watercourse. Dispose of any paint thinners, residue, and sludge(s) that cannot be recycled, as hazardous waste.
- For water-based paint, clean brushes to the extent practicable, and rinse to a drain leading to a sanitary sewer where permitted, or contain for proper disposal off site. For oil-based paints, clean brushes to the extent practicable, and filter and reuse thinners and solvents.
- Use recycled and less hazardous products when practical. Recycle residual paints, solvents, non-treated lumber, and other materials.
- Use materials only where and when needed to complete the construction activity. Use safer alternative materials as much as possible. Reduce or eliminate use of hazardous materials onsite when practical.
- Document the location, time, chemicals applied, and applicator's name and qualifications.
- Keep an ample supply of spill clean up material near use areas. Train employees in spill clean up procedures.
- Avoid exposing applied materials to rainfall and runoff unless sufficient time has been allowed for them to dry.
- Discontinue use of erodible landscape material within 2 days prior to a forecasted rain event and materials should be covered and/or bermed.

- Provide containment for material use areas such as masons' areas or paint mixing/preparation areas to prevent materials/pollutants from entering stormwater.

Costs
All of the above are low cost measures.

Inspection and Maintenance
- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Ensure employees and subcontractors throughout the job are using appropriate practices.

References
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

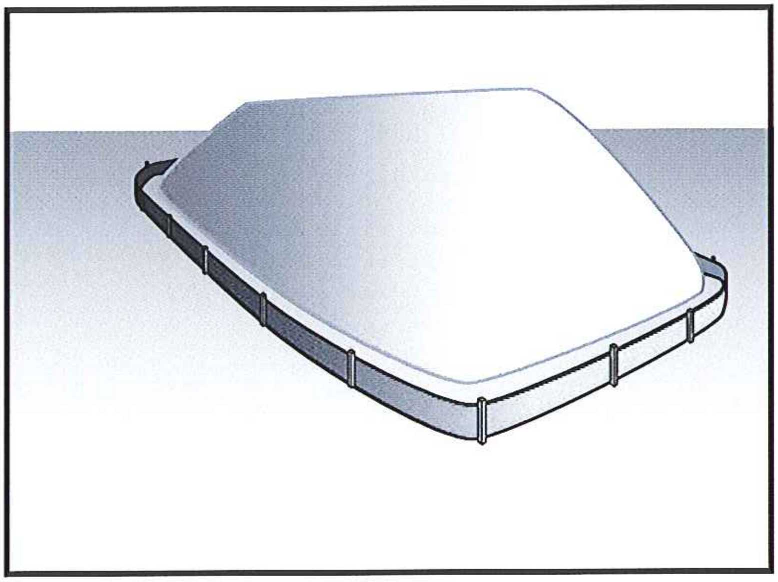
Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Comments on Risk Assessments Risk Reduction Options for Cypermethrin: Docket No. OPP–2005–0293; California Stormwater Quality Association (CASQA) letter to USEPA, 2006.Environmental Hazard and General Labeling for Pyrethroid Non-Agricultural Outdoor Products, EPA-HQ-OPP-2008-0331-0021; USEPA, 2008.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Stockpile Management



Categories

EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☒
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Stockpile management procedures and practices are designed to reduce or eliminate air and stormwater pollution from stockpiles of soil, soil amendments, sand, paving materials such as portland cement concrete (PCC) rubble, asphalt concrete (AC), asphalt concrete rubble, aggregate base, aggregate sub base or pre-mixed aggregate, asphalt minder (so called "cold mix" asphalt), and pressure treated wood.

Suitable Applications

Implement in all projects that stockpile soil and other loose materials.

Limitations

- Plastic sheeting as a stockpile protection is temporary and hard to manage in windy conditions. Where plastic is used, consider use of plastic tarps with nylon reinforcement which may be more durable than standard sheeting.
- Plastic sheeting can increase runoff volume due to lack of infiltration and potentially cause perimeter control failure.
- Plastic sheeting breaks down faster in sunlight.
- The use of Plastic materials and photodegradable plastics should be avoided.

Implementation

Protection of stockpiles is a year-round requirement. To properly manage stockpiles:

- On larger sites, a minimum of 50 ft separation from concentrated flows of stormwater, drainage courses, and inlets is recommended.
- All stockpiles are required to be protected immediately if they are not scheduled to be used within 14 days.
- Protect all stockpiles from stormwater runon using temporary perimeter sediment barriers such as compost berms (SE-13), temporary silt dikes (SE-12), fiber rolls (SE-5), silt fences (SE-1), sandbags (SE-8), gravel bags (SE-6), or biofilter bags (SE-14). Refer to the individual fact sheet for each of these controls for installation information.
- Implement wind erosion control practices as appropriate on all stockpiled material. For specific information, see WE-1, Wind Erosion Control.
- Manage stockpiles of contaminated soil in accordance with WM-7, Contaminated Soil Management.
- Place bagged materials on pallets and under cover.
- Ensure that stockpile coverings are installed securely to protect from wind and rain.
- Some plastic covers withstand weather and sunlight better than others. Select cover materials or methods based on anticipated duration of use.

Protection of Non-Active Stockpiles

Non-active stockpiles of the identified materials should be protected further as follows:

Soil stockpiles

- Soil stockpiles should be covered or protected with soil stabilization measures and a temporary perimeter sediment barrier at all times.
- Temporary vegetation should be considered for topsoil piles that will be stockpiled for extended periods.

Stockpiles of Portland cement concrete rubble, asphalt concrete, asphalt concrete rubble, aggregate base, or aggregate sub base

- Stockpiles should be covered and protected with a temporary perimeter sediment barrier at all times.

Stockpiles of "cold mix"

- Cold mix stockpiles should be placed on and covered with plastic sheeting or comparable material at all times and surrounded by a berm.

Stockpiles of fly ash, stucco, hydrated lime

- Stockpiles of materials that may raise the pH of runoff (i.e., basic materials) should be covered with plastic and surrounded by a berm.

Stockpiles/Storage of wood (Pressure treated with chromated copper arsenate or ammoniacal copper zinc arsenate

- Treated wood should be covered with plastic sheeting or comparable material at all times and surrounded by a berm.

Protection of Active Stockpiles

Active stockpiles of the identified materials should be protected as follows:

- All stockpiles should be covered and protected with a temporary linear sediment barrier prior to the onset of precipitation.
- Stockpiles of "cold mix" and treated wood, and basic materials should be placed on and covered with plastic sheeting or comparable material and surrounded by a berm prior to the onset of precipitation.
- The downstream perimeter of an active stockpile should be protected with a linear sediment barrier or berm and runoff should be diverted around or away from the stockpile on the upstream perimeter.

Costs

For cost information associated with stockpile protection refer to the individual erosion or sediment control BMP fact sheet considered for implementation (For example, refer to SE-1 Silt Fence for installation of silt fence around the perimeter of a stockpile.)

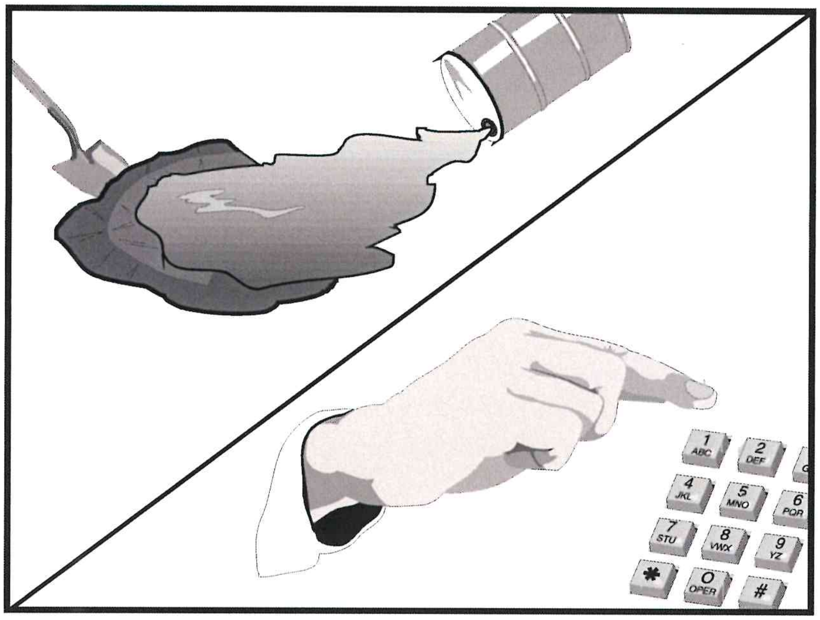
Inspection and Maintenance

- Stockpiles must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- It may be necessary to inspect stockpiles covered with plastic sheeting more frequently during certain conditions (for example, high winds or extreme heat).
- Repair and/or replace perimeter controls and covers as needed to keep them functioning properly.
- Sediment shall be removed when it reaches one-third of the barrier height.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Spill Prevention and Control WM-4



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Prevent or reduce the discharge of pollutants to drainage systems or watercourses from leaks and spills by reducing the chance for spills, stopping the source of spills, containing and cleaning up spills, properly disposing of spill materials, and training employees.

This best management practice covers only spill prevention and control. However, WM-1, Materials Delivery and Storage, and WM-2, Material Use, also contain useful information, particularly on spill prevention. For information on wastes, see the waste management BMPs in this section.

Suitable Applications

This BMP is suitable for all construction projects. Spill control procedures are implemented anytime chemicals or hazardous substances are stored on the construction site, including the following materials:

- Soil stabilizers/binders
- Dust palliatives
- Herbicides
- Growth inhibitors
- Fertilizers
- Deicing/anti-icing chemicals

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- Fuels
- Lubricants
- Other petroleum distillates

Limitations

- In some cases it may be necessary to use a private spill cleanup company.
- This BMP applies to spills caused by the contractor and subcontractors.
- Procedures and practices presented in this BMP are general. Contractor should identify appropriate practices for the specific materials used or stored onsite

Implementation

The following steps will help reduce the stormwater impacts of leaks and spills:

Education

- Be aware that different materials pollute in different amounts. Make sure that each employee knows what a "significant spill" is for each material they use, and what is the appropriate response for "significant" and "insignificant" spills.
- Educate employees and subcontractors on potential dangers to humans and the environment from spills and leaks.
- Hold regular meetings to discuss and reinforce appropriate disposal procedures (incorporate into regular safety meetings).
- Establish a continuing education program to indoctrinate new employees.
- Have contractor's superintendent or representative oversee and enforce proper spill prevention and control measures.

General Measures

- To the extent that the work can be accomplished safely, spills of oil, petroleum products, substances listed under 40 CFR parts 110,117, and 302, and sanitary and septic wastes should be contained and cleaned up immediately.
- Store hazardous materials and wastes in covered containers and protect from vandalism.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Train employees in spill prevention and cleanup.
- Designate responsible individuals to oversee and enforce control measures.
- Spills should be covered and protected from stormwater runon during rainfall to the extent that it doesn't compromise clean up activities.
- Do not bury or wash spills with water.

- Store and dispose of used clean up materials, contaminated materials, and recovered spill material that is no longer suitable for the intended purpose in conformance with the provisions in applicable BMPs.
- Do not allow water used for cleaning and decontamination to enter storm drains or watercourses. Collect and dispose of contaminated water in accordance with WM-10, Liquid Waste Management.
- Contain water overflow or minor water spillage and do not allow it to discharge into drainage facilities or watercourses.
- Place proper storage, cleanup, and spill reporting instructions for hazardous materials stored or used on the project site in an open, conspicuous, and accessible location.
- Keep waste storage areas clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored. Perimeter controls, containment structures, covers, and liners should be repaired or replaced as needed to maintain proper function.

Cleanup

- Clean up leaks and spills immediately.
- Use a rag for small spills on paved surfaces, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to either a certified laundry (rags) or disposed of as hazardous waste.
- Never hose down or bury dry material spills. Clean up as much of the material as possible and dispose of properly. See the waste management BMPs in this section for specific information.

Minor Spills

- Minor spills typically involve small quantities of oil, gasoline, paint, etc. which can be controlled by the first responder at the discovery of the spill.
- Use absorbent materials on small spills rather than hosing down or burying the spill.
- Absorbent materials should be promptly removed and disposed of properly.
- Follow the practice below for a minor spill:
  - Contain the spread of the spill.
  - Recover spilled materials.
  - Clean the contaminated area and properly dispose of contaminated materials.

Semi-Significant Spills

- Semi-significant spills still can be controlled by the first responder along with the aid of other personnel such as laborers and the foreman, etc. This response may require the cessation of all other activities.

- Spills should be cleaned up immediately:
  - Contain spread of the spill.
  - Notify the project foreman immediately.
  - If the spill occurs on paved or impermeable surfaces, clean up using "dry" methods (absorbent materials, cat litter and/or rags). Contain the spill by encircling with absorbent materials and do not let the spill spread widely.
  - If the spill occurs in dirt areas, immediately contain the spill by constructing an earthen dike. Dig up and properly dispose of contaminated soil.
  - If the spill occurs during rain, cover spill with tarps or other material to prevent contaminating runoff.

Significant/Hazardous Spills

- For significant or hazardous spills that cannot be controlled by personnel in the immediate vicinity, the following steps should be taken:
  - Notify the local emergency response by dialing 911. In addition to 911, the contractor will notify the proper county officials. It is the contractor's responsibility to have all emergency phone numbers at the construction site.
  - Notify the Governor's Office of Emergency Services Warning Center, (916) 845-8911.
  - For spills of federal reportable quantities, in conformance with the requirements in 40 CFR parts 110,119, and 302, the contractor should notify the National Response Center at (800) 424-8802.
  - Notification should first be made by telephone and followed up with a written report.
  - The services of a spills contractor or a Haz-Mat team should be obtained immediately. Construction personnel should not attempt to clean up until the appropriate and qualified staffs have arrived at the job site.
  - Other agencies which may need to be consulted include, but are not limited to, the Fire Department, the Public Works Department, the Coast Guard, the Highway Patrol, the City/County Police Department, Department of Toxic Substances, California Division of Oil and Gas, Cal/OSHA, etc.

Reporting

- Report significant spills to local agencies, such as the Fire Department; they can assist in cleanup.
- Federal regulations require that any significant oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hours).

Use the following measures related to specific activities:

Vehicle and Equipment Maintenance

- If maintenance must occur onsite, use a designated area and a secondary containment, located away from drainage courses, to prevent the runon of stormwater and the runoff of spills.
- Regularly inspect onsite vehicles and equipment for leaks and repair immediately
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Place drip pans or absorbent materials under paving equipment when not in use.
- Use absorbent materials on small spills rather than hosing down or burying the spill. Remove the absorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around
- Oil filters disposed of in trashcans or dumpsters can leak oil and pollute stormwater. Place the oil filter in a funnel over a waste oil-recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask the oil supplier or recycler about recycling oil filters.
- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Vehicle and Equipment Fueling

- If fueling must occur onsite, use designate areas, located away from drainage courses, to prevent the runon of stormwater and the runoff of spills.
- Discourage "topping off" of fuel tanks.
- Always use secondary containment, such as a drain pan, when fueling to catch spills/ leaks.

Costs

Prevention of leaks and spills is inexpensive. Treatment and/ or disposal of contaminated soil or water can be quite expensive.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.
- Keep ample supplies of spill control and cleanup materials onsite, near storage, unloading, and maintenance areas.
- Update your spill prevention and control plan and stock cleanup materials as changes occur in the types of chemicals onsite.

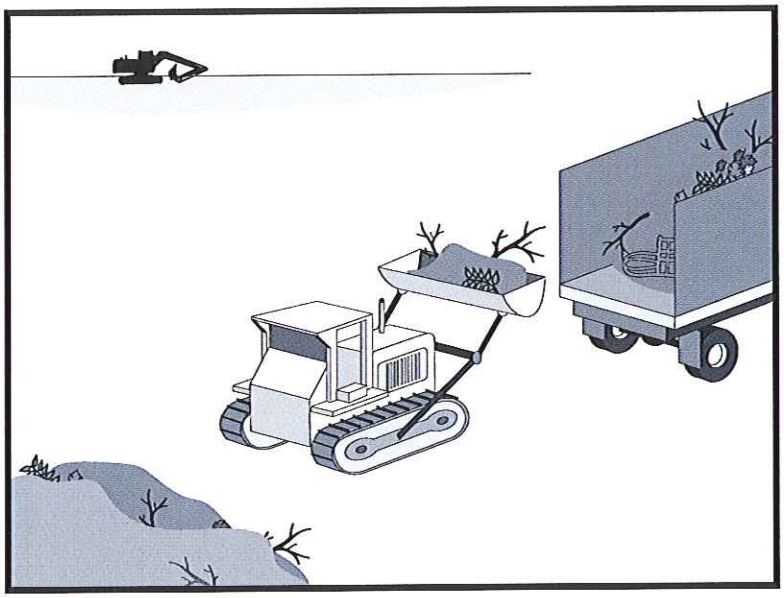
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Solid Waste Management WM-5



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Solid waste management procedures and practices are designed to prevent or reduce the discharge of pollutants to stormwater from solid or construction waste by providing designated waste collection areas and containers, arranging for regular disposal, and training employees and subcontractors.

Suitable Applications

This BMP is suitable for construction sites where the following wastes are generated or stored:

- Solid waste generated from trees and shrubs removed during land clearing, demolition of existing structures (rubble), and building construction
- Packaging materials including wood, paper, and plastic
- Scrap or surplus building materials including scrap metals, rubber, plastic, glass pieces and masonry products
- Domestic wastes including food containers such as beverage cans, coffee cups, paper bags, plastic wrappers, and cigarettes
- Construction wastes including brick, mortar, timber, steel and metal scraps, pipe and electrical cuttings, non-hazardous equipment parts, styrofoam and other materials used to transport and package construction materials
- Highway planting wastes, including vegetative material,

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plant containers, and packaging materials

Limitations

Temporary stockpiling of certain construction wastes may not necessitate stringent drainage related controls during the non-rainy season or in desert areas with low rainfall.

Implementation

The following steps will help keep a clean site and reduce stormwater pollution:

- Select designated waste collection areas onsite.
- Inform trash-hauling contractors that you will accept only watertight dumpsters for onsite use. Inspect dumpsters for leaks and repair any dumpster that is not watertight.
- Locate containers in a covered area or in a secondary containment.
- Provide an adequate number of containers with lids or covers that can be placed over the container to keep rain out or to prevent loss of wastes when it is windy.
- Plan for additional containers and more frequent pickup during the demolition phase of construction.
- Collect site trash daily, especially during rainy and windy conditions.
- Remove this solid waste promptly since erosion and sediment control devices tend to collect litter.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Do not hose out dumpsters on the construction site. Leave dumpster cleaning to the trash hauling contractor.
- Arrange for regular waste collection before containers overflow.
- Clean up immediately if a container does spill.
- Make sure that construction waste is collected, removed, and disposed of only at authorized disposal areas.

Education

- Have the contractor's superintendent or representative oversee and enforce proper solid waste management procedures and practices.
- Instruct employees and subcontractors on identification of solid waste and hazardous waste.
- Educate employees and subcontractors on solid waste storage and disposal procedures.
- Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings).

- Require that employees and subcontractors follow solid waste handling and storage procedures.
- Prohibit littering by employees, subcontractors, and visitors.
- Minimize production of solid waste materials wherever possible.

Collection, Storage, and Disposal

- Littering on the project site should be prohibited.
- To prevent clogging of the storm drainage system, litter and debris removal from drainage grates, trash racks, and ditch lines should be a priority.
- Trash receptacles should be provided in the contractor's yard, field trailer areas, and at locations where workers congregate for lunch and break periods.
- Litter from work areas within the construction limits of the project site should be collected and placed in watertight dumpsters at least weekly, regardless of whether the litter was generated by the contractor, the public, or others. Collected litter and debris should not be placed in or next to drain inlets, stormwater drainage systems, or watercourses.
- Dumpsters of sufficient size and number should be provided to contain the solid waste generated by the project.
- Full dumpsters should be removed from the project site and the contents should be disposed of by the trash hauling contractor.
- Construction debris and waste should be removed from the site biweekly or more frequently as needed.
- Construction material visible to the public should be stored or stacked in an orderly manner.
- Stormwater runon should be prevented from contacting stored solid waste through the use of berms, dikes, or other temporary diversion structures or through the use of measures to elevate waste from site surfaces.
- Solid waste storage areas should be located at least 50 ft from drainage facilities and watercourses and should not be located in areas prone to flooding or ponding.
- Except during fair weather, construction and highway planting waste not stored in watertight dumpsters should be securely covered from wind and rain by covering the waste with tarps or plastic.
- Segregate potentially hazardous waste from non-hazardous construction site waste.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- For disposal of hazardous waste, see WM-6, Hazardous Waste Management. Have hazardous waste hauled to an appropriate disposal and/or recycling facility.

- Salvage or recycle useful vegetation debris, packaging and surplus building materials when practical. For example, trees and shrubs from land clearing can be used as a brush barrier, or converted into wood chips, then used as mulch on graded areas. Wood pallets, cardboard boxes, and construction scraps can also be recycled.

Costs
All of the above are low cost measures.

Inspection and Maintenance
- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.

- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur

- Inspect construction waste area regularly.

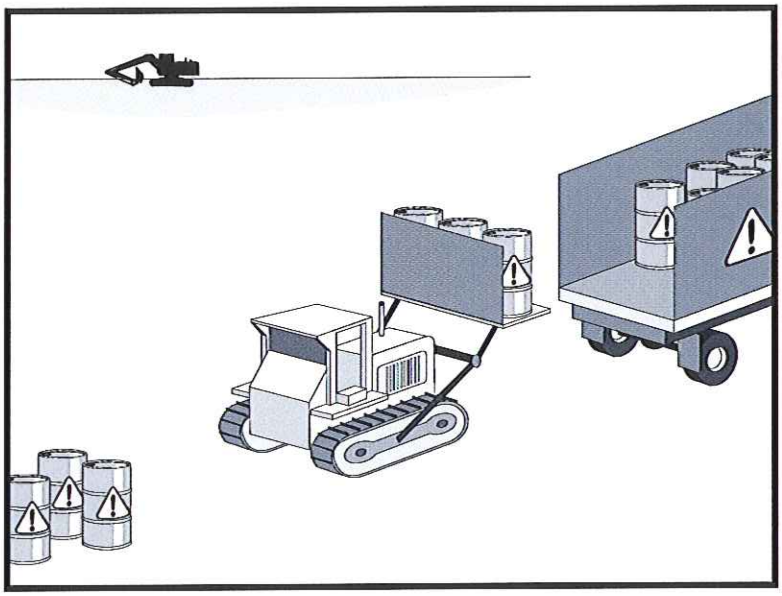
- Arrange for regular waste collection.

References
Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity, 430/9-73-007, USEPA, 1973.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Hazardous Waste Management WM-6



Categories

EC	Erosion Control	
SE	Sediment Control	
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WE	Wind Erosion Control	
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Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Prevent or reduce the discharge of pollutants to stormwater from hazardous waste through proper material use, waste disposal, and training of employees and subcontractors.

Suitable Applications

This best management practice (BMP) applies to all construction projects. Hazardous waste management practices are implemented on construction projects that generate waste from the use of:

- Petroleum Products
- Asphalt Products
- Concrete Curing Compounds
- Pesticides
- Palliatives
- Acids
- Septic Wastes
- Paints
- Stains
- Solvents
- Wood Preservatives
- Roofing Tar
- Any materials deemed a hazardous waste in California, Title 22 Division 4.5, or listed in 40 CFR Parts 110, 117, 261, or 302

In addition, sites with existing structures may contain wastes, which must be disposed of in accordance with federal, state, and local regulations. These wastes include:

- Sandblasting grit mixed with lead-, cadmium-, or chromium-based paints
- Asbestos
- PCBs (particularly in older transformers)

Limitations

- Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.
- Nothing in this BMP relieves the contractor from responsibility for compliance with federal, state, and local laws regarding storage, handling, transportation, and disposal of hazardous wastes.
- This BMP does not cover aerially deposited lead (ADL) soils. For ADL soils refer to WM-7, Contaminated Soil Management.

Implementation

The following steps will help reduce stormwater pollution from hazardous wastes:

Material Use

- Wastes should be stored in sealed containers constructed of a suitable material and should be labeled as required by Title 22 CCR, Division 4.5 and 49 CFR Parts 172, 173, 178, and 179.
- All hazardous waste should be stored, transported, and disposed as required in Title 22 CCR, Division 4.5 and 49 CFR 261-263.
- Waste containers should be stored in temporary containment facilities that should comply with the following requirements:
    - Temporary containment facility should provide for a spill containment volume equal to 1.5 times the volume of all containers able to contain precipitation from a 25 year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest tank within its boundary, whichever is greater.
    - Temporary containment facility should be impervious to the materials stored there for a minimum contact time of 72 hours.
    - Temporary containment facilities should be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills should be placed into drums after each rainfall. These liquids should be handled as a hazardous waste unless testing determines them to be non-hazardous. Non-hazardous liquids should be sent to an approved disposal site.
    - Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.

- Incompatible materials, such as chlorine and ammonia, should not be stored in the same temporary containment facility.

- Throughout the rainy season, temporary containment facilities should be covered during non-working days, and prior to rain events. Covered facilities may include use of plastic tarps for small facilities or constructed roofs with overhangs.

- Drums should not be overfilled and wastes should not be mixed.

- Unless watertight, containers of dry waste should be stored on pallets.

- Do not over-apply herbicides and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over application is expensive and environmentally harmful. Apply surface dressings in several smaller applications, as opposed to one large application. Allow time for infiltration and avoid excess material being carried offsite by runoff. Do not apply these chemicals just before it rains. People applying pesticides must be certified in accordance with federal and state regulations.

- Paint brushes and equipment for water and oil based paints should be cleaned within a contained area and should not be allowed to contaminate site soils, watercourses, or drainage systems. Waste paints, thinners, solvents, residues, and sludges that cannot be recycled or reused should be disposed of as hazardous waste. When thoroughly dry, latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths should be disposed of as solid waste.

- Do not clean out brushes or rinse paint containers into the dirt, street, gutter, storm drain, or stream. "Paint out" brushes as much as possible. Rinse water-based paints to the sanitary sewer. Filter and reuse thinners and solvents. Dispose of excess oil-based paints and sludge as hazardous waste.

- The following actions should be taken with respect to temporary contaminant:

  - Ensure that adequate hazardous waste storage volume is available.

  - Ensure that hazardous waste collection containers are conveniently located.

  - Designate hazardous waste storage areas onsite away from storm drains or watercourses and away from moving vehicles and equipment to prevent accidental spills.

  - Minimize production or generation of hazardous materials and hazardous waste on the job site.

  - Use containment berms in fueling and maintenance areas and where the potential for spills is high.

  - Segregate potentially hazardous waste from non-hazardous construction site debris.

  - Keep liquid or semi-liquid hazardous waste in appropriate containers (closed drums or similar) and under cover.

- Clearly label all hazardous waste containers with the waste being stored and the date of accumulation.
- Place hazardous waste containers in secondary containment.
- Do not allow potentially hazardous waste materials to accumulate on the ground.
- Do not mix wastes.
- Use all of the product before disposing of the container.
- Do not remove the original product label; it contains important safety and disposal information.

Waste Recycling Disposal

- Select designated hazardous waste collection areas onsite.
- Hazardous materials and wastes should be stored in covered containers and protected from vandalism.
- Place hazardous waste containers in secondary containment.
- Do not mix wastes, this can cause chemical reactions, making recycling impossible and complicating disposal.
- Recycle any useful materials such as used oil or water-based paint.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Arrange for regular waste collection before containers overflow.
- Make sure that hazardous waste (e.g., excess oil-based paint and sludge) is collected, removed, and disposed of only at authorized disposal areas.

Disposal Procedures

- Waste should be disposed of by a licensed hazardous waste transporter at an authorized and licensed disposal facility or recycling facility utilizing properly completed Uniform Hazardous Waste Manifest forms.
- A Department of Health Services certified laboratory should sample waste to determine the appropriate disposal facility.
- Properly dispose of rainwater in secondary containment that may have mixed with hazardous waste.
- Attention is directed to "Hazardous Material", "Contaminated Material", and "Aerially Deposited Lead" of the contract documents regarding the handling and disposal of hazardous materials.

Education

- Educate employees and subcontractors on hazardous waste storage and disposal procedures.
- Educate employees and subcontractors on potential dangers to humans and the environment from hazardous wastes.
- Instruct employees and subcontractors on safety procedures for common construction site hazardous wastes.
- Instruct employees and subcontractors in identification of hazardous and solid waste.
- Hold regular meetings to discuss and reinforce hazardous waste management procedures (incorporate into regular safety meetings).
- The contractor's superintendent or representative should oversee and enforce proper hazardous waste management procedures and practices.
- Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.
- Warning signs should be placed in areas recently treated with chemicals.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- If a container does spill, clean up immediately.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur
- Hazardous waste should be regularly collected.
- A foreman or construction supervisor should monitor onsite hazardous waste storage and disposal procedures.
- Waste storage areas should be kept clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored.
- Perimeter controls, containment structures, covers, and liners should be repaired or replaced as needed to maintain proper function.
- Hazardous spills should be cleaned up and reported in conformance with the applicable Material Safety Data Sheet (MSDS) and the instructions posted at the project site.

- The National Response Center, at (800) 424-8802, should be notified of spills of federal reportable quantities in conformance with the requirements in 40 CFR parts 110, 117, and 302. Also notify the Governors Office of Emergency Services Warning Center at (916) 845-8911.

- A copy of the hazardous waste manifests should be provided.

References

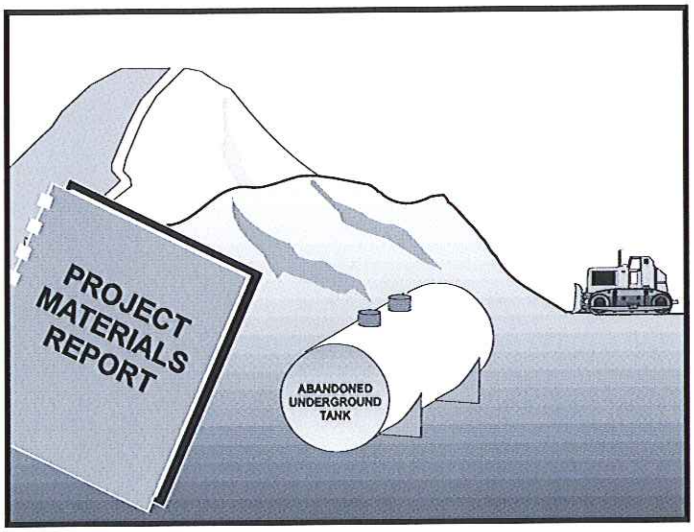
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity, 430/9-73-007, USEPA, 1973.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Contaminated Soil Management WM-7



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Prevent or reduce the discharge of pollutants to stormwater from contaminated soil and highly acidic or alkaline soils by conducting pre-construction surveys, inspecting excavations regularly, and remediating contaminated soil promptly.

Suitable Applications

Contaminated soil management is implemented on construction projects in highly urbanized or industrial areas where soil contamination may have occurred due to spills, illicit discharges, aerial deposition, past use and leaks from underground storage tanks.

Limitations

Contaminated soils that cannot be treated onsite must be disposed of offsite by a licensed hazardous waste hauler. The presence of contaminated soil may indicate contaminated water as well. See NS-2, Dewatering Operations, for more information.

The procedures and practices presented in this BMP are general. The contractor should identify appropriate practices and procedures for the specific contaminants known to exist or discovered onsite.

Implementation

Most owners and developers conduct pre-construction environmental assessments as a matter of routine. Contaminated soils are often identified during project planning and development with known locations identified in the plans, specifications and in the SWPPP. The contractor should review applicable reports and investigate appropriate call-outs in the plans, specifications, and SWPPP. Recent court rulings holding contractors liable for cleanup costs when they unknowingly move contaminated soil highlight the need for contractors to confirm a site assessment is completed before earth moving begins.

The following steps will help reduce stormwater pollution from contaminated soil:

- Conduct thorough, pre-construction inspections of the site and review documents related to the site. If inspection or reviews indicated presence of contaminated soils, develop a plan before starting work.
- Look for contaminated soil as evidenced by discoloration, odors, differences in soil properties, abandoned underground tanks or pipes, or buried debris.
- Prevent leaks and spills. Contaminated soil can be expensive to treat and dispose of properly. However, addressing the problem before construction is much less expensive than after the structures are in place.
- The contractor may further identify contaminated soils by investigating:
  - Past site uses and activities
  - Detected or undetected spills and leaks
  - Acid or alkaline solutions from exposed soil or rock formations high in acid or alkaline forming elements
  - Contaminated soil as evidenced by discoloration, odors, differences in soil properties, abandoned underground tanks or pipes, or buried debris.
  - Suspected soils should be tested at a certified laboratory.

Education

- Have employees and subcontractors complete a safety training program which meets 29 CFR 1910.120 and 8 CCR 5192 covering the potential hazards as identified, prior to performing any excavation work at the locations containing material classified as hazardous.
- Educate employees and subcontractors in identification of contaminated soil and on contaminated soil handling and disposal procedures.
- Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings).

Handling Procedures for Material with Aerially Deposited Lead (ADL)

- Materials from areas designated as containing (ADL) may, if allowed by the contract special provisions, be excavated, transported, and used in the construction of embankments and/or backfill.
- Excavation, transportation, and placement operations should result in no visible dust.
- Caution should be exercised to prevent spillage of lead containing material during transport.

- Quality should be monitored during excavation of soils contaminated with lead.

Handling Procedures for Contaminated Soils

- Minimize onsite storage. Contaminated soil should be disposed of properly in accordance with all applicable regulations. All hazardous waste storage will comply with the requirements in Title 22, CCR, Sections 66265.250 to 66265.260.
- Test suspected soils at an approved certified laboratory.
- Work with the local regulatory agencies to develop options for treatment or disposal if the soil is contaminated.
- Avoid temporary stockpiling of contaminated soils or hazardous material.
- Take the following precautions if temporary stockpiling is necessary:
  - Cover the stockpile with plastic sheeting or tarps.
  - Install a berm around the stockpile to prevent runoff from leaving the area.
  - Do not stockpile in or near storm drains or watercourses.
- Remove contaminated material and hazardous material on exteriors of transport vehicles and place either into the current transport vehicle or into the excavation prior to the vehicle leaving the exclusion zone.
- Monitor the air quality continuously during excavation operations at all locations containing hazardous material.
- Procure all permits and licenses, pay all charges and fees, and give all notices necessary and incident to the due and lawful prosecution of the work, including registration for transporting vehicles carrying the contaminated material and the hazardous material.
- Collect water from decontamination procedures and treat or dispose of it at an appropriate disposal site.
- Collect non-reusable protective equipment, once used by any personnel, and dispose of at an appropriate disposal site.
- Install temporary security fence to surround and secure the exclusion zone. Remove fencing when no longer needed.
- Excavate, transport, and dispose of contaminated material and hazardous material in accordance with the rules and regulations of the following agencies (the specifications of these agencies supersede the procedures outlined in this BMP):
  - United States Department of Transportation (USDOT)
  - United States Environmental Protection Agency (USEPA)
  - California Environmental Protection Agency (CAL-EPA)

- California Division of Occupation Safety and Health Administration (CAL-OSHA)
- Local regulatory agencies

Procedures for Underground Storage Tank Removals

- Prior to commencing tank removal operations, obtain the required underground storage tank removal permits and approval from the federal, state, and local agencies that have jurisdiction over such work.
- To determine if it contains hazardous substances, arrange to have tested, any liquid or sludge found in the underground tank prior to its removal.
- Following the tank removal, take soil samples beneath the excavated tank and perform analysis as required by the local agency representative(s).
- The underground storage tank, any liquid or sludge found within the tank, and all contaminated substances and hazardous substances removed during the tank removal and transported to disposal facilities permitted to accept such waste.

Water Control

- All necessary precautions and preventive measures should be taken to prevent the flow of water, including ground water, from mixing with hazardous substances or underground storage tank excavations. Such preventative measures may consist of, but are not limited to, berms, cofferdams, grout curtains, freeze walls, and seal course concrete or any combination thereof.
- If water does enter an excavation and becomes contaminated, such water, when necessary to proceed with the work, should be discharged to clean, closed top, watertight transportable holding tanks, treated, and disposed of in accordance with federal, state, and local laws.

Costs

Prevention of leaks and spills is inexpensive. Treatment or disposal of contaminated soil can be quite expensive.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Arrange for contractor's Water Pollution Control Manager, foreman, and/or construction supervisor to monitor onsite contaminated soil storage and disposal procedures.
- Monitor air quality continuously during excavation operations at all locations containing hazardous material.
- Coordinate contaminated soils and hazardous substances/waste management with the appropriate federal, state, and local agencies.

- Implement WM-4, Spill Prevention and Control, to prevent leaks and spills as much as possible.

References

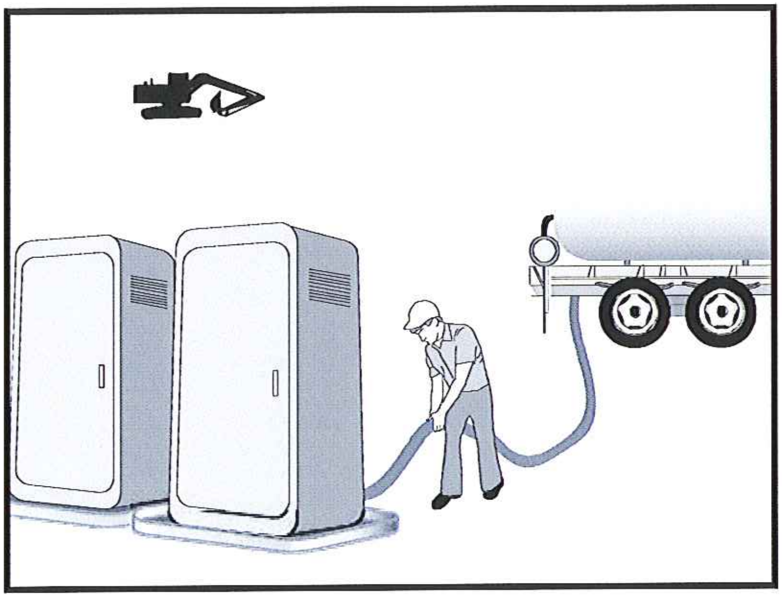
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity, 430/9-73-007, USEPA, 1973.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Sanitary/Septic Waste Management WM-9



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	
Nutrients	☑
Trash	☑
Metals	
Bacteria	☑
Oil and Grease	
Organics	☑

Potential Alternatives

None

Description and Purpose

Proper sanitary and septic waste management prevent the discharge of pollutants to stormwater from sanitary and septic waste by providing convenient, well-maintained facilities, and arranging for regular service and disposal.

Suitable Applications

Sanitary septic waste management practices are suitable for use at all construction sites that use temporary or portable sanitary and septic waste systems.

Limitations

None identified.

Implementation

Sanitary or septic wastes should be treated or disposed of in accordance with state and local requirements. In many cases, one contract with a local facility supplier will be all that it takes to make sure sanitary wastes are properly disposed.

Storage and Disposal Procedures

- Temporary sanitary facilities should be located away from drainage facilities, watercourses, and from traffic circulation. If site conditions allow, place portable facilities a minimum of 50 feet from drainage conveyances and traffic areas. When subjected to high winds or risk of high winds, temporary sanitary facilities should be secured to prevent overturning.

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- Temporary sanitary facilities must be equipped with containment to prevent discharge of pollutants to the stormwater drainage system of the receiving water.
- Consider safety as well as environmental implications before placing temporary sanitary facilities.
- Wastewater should not be discharged or buried within the project site.
- Sanitary and septic systems that discharge directly into sanitary sewer systems, where permissible, should comply with the local health agency, city, county, and sewer district requirements.
- Only reputable, licensed sanitary and septic waste haulers should be used.
- Sanitary facilities should be located in a convenient location.
- Temporary septic systems should treat wastes to appropriate levels before discharging.
- If using an onsite disposal system (OSDS), such as a septic system, local health agency requirements must be followed.
- Temporary sanitary facilities that discharge to the sanitary sewer system should be properly connected to avoid illicit discharges.
- Sanitary and septic facilities should be maintained in good working order by a licensed service.
- Regular waste collection by a licensed hauler should be arranged before facilities overflow.
- If a spill does occur from a temporary sanitary facility, follow federal, state and local regulations for containment and clean-up.

Education

- Educate employees, subcontractors, and suppliers on sanitary and septic waste storage and disposal procedures.
- Educate employees, subcontractors, and suppliers of potential dangers to humans and the environment from sanitary and septic wastes.
- Instruct employees, subcontractors, and suppliers in identification of sanitary and septic waste.
- Hold regular meetings to discuss and reinforce the use of sanitary facilities (incorporate into regular safety meetings).
- Establish a continuing education program to indoctrinate new employees.

Costs

All of the above are low cost measures.

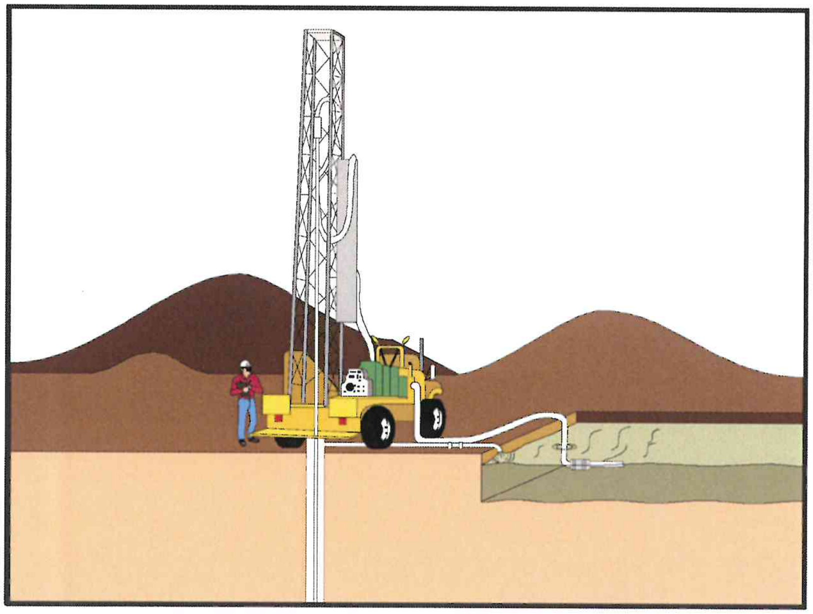
Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Arrange for regular waste collection.
- If high winds are expected, portable sanitary facilities must be secured with spikes or weighed down to prevent over turning.
- If spills or leaks from sanitary or septic facilities occur that are not contained and discharge from the site, non-visible sampling of site discharge may be required. Refer to the General Permit or to your project specific Construction Site Monitoring Plan to determine if and where sampling is required.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

Liquid waste management includes procedures and practices to prevent discharge of pollutants to the storm drain system or to watercourses as a result of the creation, collection, and disposal of non-hazardous liquid wastes.

Suitable Applications

Liquid waste management is applicable to construction projects that generate any of the following non-hazardous by-products, residuals, or wastes:

- Drilling slurries and drilling fluids
- Grease-free and oil-free wastewater and rinse water
- Dredgings
- Other non-stormwater liquid discharges not permitted by separate permits

Limitations

- Disposal of some liquid wastes may be subject to specific laws and regulations or to requirements of other permits secured for the construction project (e.g., NPDES permits, Army Corps permits, Coastal Commission permits, etc.).
- Liquid waste management does not apply to dewatering operations (NS-2 Dewatering Operations), solid waste management (WM-5, Solid Waste Management), hazardous wastes (WM-6, Hazardous Waste Management), or concrete slurry residue (WM-8, Concrete Waste

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Management).

- Typical permitted non-stormwater discharges can include: water line flushing; landscape irrigation; diverted stream flows; rising ground waters; uncontaminated pumped ground water; discharges from potable water sources; foundation drains; irrigation water; springs; water from crawl space pumps; footing drains; lawn watering; flows from riparian habitats and wetlands; and discharges or flows from emergency fire fighting activities.

Implementation

General Practices

- Instruct employees and subcontractors how to safely differentiate between non-hazardous liquid waste and potential or known hazardous liquid waste.

- Instruct employees, subcontractors, and suppliers that it is unacceptable for any liquid waste to enter any storm drainage device, waterway, or receiving water.

- Educate employees and subcontractors on liquid waste generating activities and liquid waste storage and disposal procedures.

- Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings).

- Verify which non-stormwater discharges are permitted by the statewide NPDES permit; different regions might have different requirements not outlined in this permit.

- Apply NS-8, Vehicle and Equipment Cleaning for managing wash water and rinse water from vehicle and equipment cleaning operations.

Containing Liquid Wastes

- Drilling residue and drilling fluids should not be allowed to enter storm drains and watercourses and should be disposed of.

- If an appropriate location is available, drilling residue and drilling fluids that are exempt under Title 23, CCR § 2511(g) may be dried by infiltration and evaporation in a containment facility constructed in conformance with the provisions concerning the Temporary Concrete Washout Facilities detailed in WM-8, Concrete Waste Management.

- Liquid wastes generated as part of an operational procedure, such as water-laden dredged material and drilling mud, should be contained and not allowed to flow into drainage channels or receiving waters prior to treatment.

- Liquid wastes should be contained in a controlled area such as a holding pit, sediment basin, roll-off bin, or portable tank.

- Containment devices must be structurally sound and leak free.

- Containment devices must be of sufficient quantity or volume to completely contain the liquid wastes generated.

- Precautions should be taken to avoid spills or accidental releases of contained liquid wastes. Apply the education measures and spill response procedures outlined in WM-4, Spill Prevention and Control.

- Containment areas or devices should not be located where accidental release of the contained liquid can threaten health or safety or discharge to water bodies, channels, or storm drains.

Capturing Liquid Wastes

- Capture all liquid wastes that have the potential to affect the storm drainage system (such as wash water and rinse water from cleaning walls or pavement), before they run off a surface.

- Do not allow liquid wastes to flow or discharge uncontrolled. Use temporary dikes or berms to intercept flows and direct them to a containment area or device for capture.

- Use a sediment trap (SE-3, Sediment Trap) for capturing and treating sediment laden liquid waste or capture in a containment device and allow sediment to settle.

Disposing of Liquid Wastes

- A typical method to handle liquid waste is to dewater the contained liquid waste, using procedures such as described in NS-2, Dewatering Operations, and SE-2, Sediment Basin, and dispose of resulting solids per WM-5, Solid Waste Management.

- Methods of disposal for some liquid wastes may be prescribed in Water Quality Reports, NPDES permits, Environmental Impact Reports, 401 or 404 permits, and local agency discharge permits, etc. Review the SWPPP to see if disposal methods are identified.

- Liquid wastes, such as from dredged material, may require testing and certification whether it is hazardous or not before a disposal method can be determined.

- For disposal of hazardous waste, see WM-6, Hazardous Waste Management.

- If necessary, further treat liquid wastes prior to disposal. Treatment may include, though is not limited to, sedimentation, filtration, and chemical neutralization.

Costs

Prevention costs for liquid waste management are minimal. Costs increase if cleanup or fines are involved.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.

- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.

- Remove deposited solids in containment areas and capturing devices as needed and at the completion of the task. Dispose of any solids as described in WM-5, Solid Waste Management.

- Inspect containment areas and capturing devices and repair as needed.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Appendix D: Inspection Forms

BMP INSPECTION REPORT

Date and Time of Inspection:		Date Report Written:		
Inspection Type: (Circle one)	Weekly *Complete Parts I, II, III, and VII*	Pre-Storm *Complete Parts I, II, III, IV, and VII*	During Rain Event *Complete Parts I, II, III, V, and VII*	Post-Storm *Complete Parts I, II, III, VI, and VII*
Part I. General Information				
Site Information				
Construction Site Name:				
Construction stage and completed activities:		Approximate area of site that is exposed:		
Photos Taken: (Circle one)	Yes	No	Photo Reference IDs:	
Weather				
Estimate storm beginning: (date and time)		Estimate storm duration: (hours)		
Estimate time since last storm: (days or hours)		Rain gauge reading (inches) and location:		
Is a "Qualifying Event" predicted or did one occur (i.e., 0.5" rain with 48-hrs or greater between events)? (Y/N) If yes, summarize forecast:				
Exemption Documentation (explanation required if inspection could not be conducted). Visual inspections are not required outside of business hours or during dangerous weather conditions such as flooding or electrical storms.				
Inspector Information				
Inspector Name:		Inspector Title:		
Signature:			Date:	

Part II. BMP Observations. Describe deficiencies in Part III.			
Minimum BMPs for Risk Level _____ Sites	Failures or other short-comings (yes, no, N/A)	Action Required (yes/no)	Action Implemented (Date)
Good Housekeeping for Construction Materials			
Inventory of products (excluding materials designed to be outdoors)			
Stockpiled construction materials not actively in use are covered and bermed			
All chemicals are stored in watertight containers with appropriate secondary containment, or in a completely enclosed storage shed			
Construction materials are minimally exposed to precipitation			
BMPs preventing the off-site tracking of materials are implemented and properly effective			
Good Housekeeping for Waste Management			
Wash/rinse water and materials are prevented from being disposed into the storm drain system			
Portable toilets are contained to prevent discharges of waste			
Sanitation facilities are clean and with no apparent for leaks and spills			
Equipment is in place to cover waste disposal containers at the end of the business day and during rain events			
Discharges from waste disposal containers are prevented from discharging to the storm drain system / receiving water			
Stockpiled waste material is securely protected from wind and rain if not actively in use			
Procedures are in place for addressing hazardous and non-hazardous spills			
Appropriate spill response personnel are assigned and trained			
Equipment and materials for cleanup of spills are available onsite			
Washout areas (e.g., concrete) are contained appropriately to prevent discharge or infiltration into the underlying soil			
Good Housekeeping for Vehicle Storage and Maintenance			
Measures are in place to prevent oil, grease, or fuel from leaking into the ground, storm drains, or surface waters			
All equipment or vehicles are fueled, maintained, and stored in a designated area with appropriate BMPs			
Vehicle and equipment leaks are cleaned immediately and disposed of properly			

Part II. BMP Observations (Continued). Describe deficiencies in Part III.			
Minimum BMPs for Risk Level _____ Sites	Adequately designed, implemented and effective (yes, no, N/A)	Action Required (yes/no)	Action Implemented (Date)
Good Housekeeping for Landscape Materials			
Stockpiled landscape materials such as mulches and topsoil are contained and covered when not actively in use			
Erodible landscape material has not been applied 2 days before a forecasted rain event or during an event			
Erodible landscape materials are applied at quantities and rates in accordance with manufacturer recommendations			
Bagged erodible landscape materials are stored on pallets and covered			
Good Housekeeping for Air Deposition of Site Materials			
Good housekeeping measures are implemented onsite to control the air deposition of site materials and materials from site operations			
Non-Stormwater Management			
Non-Stormwater discharges are properly controlled			
Vehicles are washed in a manner to prevent non-stormwater discharges to surface waters or drainage systems			
Streets are cleaned in a manner to prevent unauthorized non-stormwater discharges to surface waters or drainage systems.			
Erosion Controls			
Wind erosion controls are effectively implemented			
Effective soil cover is provided for disturbed areas inactive (i.e., not scheduled to be disturbed for 14 days) as well as finished slopes, open space, utility backfill, and completed lots			
The use of plastic materials is limited in cases when a more sustainable, environmentally friendly alternative exists.			
Sediment Controls			
Perimeter controls are established and effective at controlling erosion and sediment discharges from the site			
Entrances and exits are stabilized to control erosion and sediment discharges from the site			
Sediment basins are properly maintained			
Linear sediment control along toe of slope, face of slope, and at grade breaks (Risk Level 2 & 3 Only)			
Construction traffic to and from site limited to entrances and exits with effective controls to prevent off-site tracking (Risk Level 2 & 3 Only)			

All storm drain inlets and perimeter controls, runoff control BMPs, and pollutant controls at entrances and exits are maintained and protected from activities that reduce their effectiveness (Risk Level 2 & 3 Only)			
All immediate access roads inspected daily (Risk Level 2 & 3 Only)			
Run-On and Run-Off Controls			
Run-on to the site is effectively managed and directed away from all disturbed areas.			
Other			
Are the project CERCLA SWPPP and BMP plan up to date, available onsite, and being properly implemented?			

Part III. Descriptions of BMP Deficiencies		
Deficiency	**Repairs Implemented: Note - Repairs must begin within 72 hours of identification, and be completed as soon as possible.**	
	Start Date	**Action**
1.		
2.		
3.		
4.		

Part IV. Additional Pre-Storm Observations. Note the presence or absence of floating and suspended materials, sheen, discoloration, turbidity, odors, and source(s) of pollutants(s).	
	Yes, No, N/A
Do stormwater storage and containment areas have adequate freeboard? If no, complete Part III.	
Are drainage areas free of spills, leaks, or uncontrolled pollutant sources? If no, complete Part VII and describe below.	
Notes:	
Are stormwater storage and containment areas free of leaks? If no, complete Parts III and/or VII and describe below.	

Notes:	

Part V. Additional During-Storm Observations. If BMPs cannot be inspected during inclement weather, list the results of visual inspections at all relevant outfalls, discharge points, and downstream locations. Note odors or visible sheen on the surface of discharges. Complete Part VII (Corrective Actions) as needed.	
Outfall, Discharge Point, or Other Downstream Location	
Location	Description
Location	Description
Location	Description
Location	Description
Location	Description
Location	Description
Location	Description
Location	Description

Part VI. Additional Post-Storm Observations. Visually observe (inspect) stormwater discharges at all discharge locations within two business days (48 hours) after each qualifying rain event, and observe (inspect) the discharge of stored or contained stormwater that is derived from and discharged subsequent to a qualifying rain event producing precipitation of ½ inch or more at the time of discharge. Complete Part VII (Corrective Actions) as needed.	
Discharge Location, Storage or Containment Area	**Visual Observation**

Part VII. Additional Corrective Actions Required. Identify additional corrective actions not included with BMP Deficiencies (Part III) above. Note if CERCLA SWPPP change is required.	
Required Actions	**Implementation Date**

<table>
<tr><th colspan="8">Risk Level 1, 2, 3
Visual Inspection Field Log Sheet</th></tr>
<tr><td colspan="4">Date and Time of Inspection:</td><td colspan="4">Report Date:</td></tr>
<tr><td>Inspection Type:</td><td>☐ Weekly</td><td>☐ Before predicted rain</td><td>☐ During rain event</td><td>☐ Following qualifying rain event</td><td>☐ Contained stormwater release</td><td colspan="2">☐ Quarterly non-stormwater</td></tr>
<tr><th colspan="8">Site Information</th></tr>
<tr><td colspan="8">Construction Site Name:</td></tr>
<tr><td colspan="5">Construction stage and completed activities:</td><td colspan="3">Approximate area of exposed site:</td></tr>
<tr><th colspan="8">Weather and Observations</th></tr>
<tr><td colspan="4">Date Rain Predicted to Occur:</td><td colspan="4">Predicted % chance of rain:</td></tr>
<tr><td colspan="2">Estimate storm beginning:
____
(date and time)</td><td colspan="2">Estimate storm duration:
____
(hours)</td><td colspan="2">Estimate time since last storm:
____
(days or hours)</td><td colspan="2">Rain gauge reading:_
____
(inches)</td></tr>
<tr><td colspan="8">Observations: If yes identify location</td></tr>
<tr><td>Odors</td><td colspan="7">Yes ☐ No ☐</td></tr>
<tr><td>Floating material</td><td colspan="7">Yes ☐ No ☐</td></tr>
<tr><td>Suspended Material</td><td colspan="7">Yes ☐ No ☐</td></tr>
<tr><td>Sheen</td><td colspan="7">Yes ☐ No ☐</td></tr>
<tr><td>Discolorations</td><td colspan="7">Yes ☐ No ☐</td></tr>
<tr><td>Turbidity</td><td colspan="7">Yes ☐ No ☐</td></tr>
<tr><th colspan="8">Site Inspections</th></tr>
<tr><th colspan="3">Outfalls or BMPs Evaluated</th><th colspan="5">Deficiencies Noted</th></tr>
<tr><td colspan="8">(add additional sheets or attach detailed BMP Inspection Checklists)</td></tr>
<tr><td colspan="3"></td><td colspan="5"></td></tr>
<tr><td colspan="3"></td><td colspan="5"></td></tr>
<tr><td colspan="3"></td><td colspan="5"></td></tr>
<tr><td colspan="2">Photos Taken:</td><td>Yes ☐</td><td>No ☐</td><td colspan="4">Photo Reference IDs:</td></tr>
<tr><th colspan="8">Corrective Actions Identified (note if CERCLA SWPPP/REAP change is needed)</th></tr>
<tr><td colspan="8"></td></tr>
<tr><th colspan="8">Inspector Information</th></tr>
<tr><td colspan="4">Inspector Name:</td><td colspan="4">Inspector Title:</td></tr>
</table>

Signature:				Date:

Risk Level 2 **_Effluent Sampling Field Log Sheets_**		
Construction Site Name:	Date:	Time Start:
Sampler:		

Sampling Event Type:	☐ Stormwater	☐ Non-stormwater	☐ Non-visible pollutant

Field Meter Calibration	
pH Meter ID No./Desc.: Calibration Date/Time:	Turbidity Meter ID No./Desc.: Calibration Date/Time:

Field pH and Turbidity Measurements			
Discharge Location Description	pH	Turbidity	Time

Grab Samples Collected		
Discharge Location Description	Sample Type	Time

Additional Sampling Notes:
Time End:

NAL or NEL Exceedance Evaluation Summary Report	Page __ of __
Project Name	
Project WDID	
Project Location	
Date of Exceedance	
Type of Exceedance	NAL Daily Average ☐ pH ☐ Turbidity NEL Daily Average ☐ pH ☐ Turbidity ☐ Other (specify) _______________
Measurement or Analytical Method	☐ Field meter (Sensitivity: ________) ☐ Lab method (specify) __________ (Reporting Limit: _____) (MDL: _____________)
Calculated Daily Average	☐ pH _____ pH units ☐ Turbidity ____ NTU
Rain Gauge Measurement	_______ inches
Compliance Storm Event	_______ inches (5-year, 24-hour event)
Visual Observations on Day of Exceedance	

NAL or NEL Exceedance Evaluation Summary Report	Page __ of __
Description of BMPs in Place at Time of Event	
Initial Assessment of Cause	
Corrective Actions Taken (deployed after exceedance)	
Additional Corrective Actions Proposed	
Report Completed By	______________________________ (Print Name, Title)
Signature	______________________________

Appendix E: Training Reporting Form

TO BE FILLED OUT DURING CONSTRUCTION

Trained Contractor Personnel Log

Stormwater Management Training Log and Documentation

Project Name: Radiological Remediation and Support, NSTI
WDID #: ___________________________________

Stormwater Management Topic: (check as appropriate)

- ☐ Erosion Control
- ☐ Sediment Control
- ☐ Wind Erosion Control
- ☐ Tracking Control
- ☐ Non-Stormwater Management
- ☐ Waste Management and Materials Pollution Control
- ☐ Stormwater Sampling

Specific Training Objective: ____

Location: ______________________ Date: __________________________

Instructor:______________________ Telephone: _____________________

Course Length (hours): ___________

Attendee Roster (Attach additional forms if necessary)

Name	Company	Phone

As needed, add proof of external training (e.g., course completion certificates, credentials for QSP, QSD).

Appendix F: Monitoring Record

TO BE FILLED OUT DURING CONSTRUCTION

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Naval Facilities Engineering Command Southwest
BRAC PMO West
San Diego, CA

FINAL
REMEDIAL ACTION/NON-TIME CRITICAL REMOVAL ACTION DUST CONTROL PLAN

Installation Restoration Site 12

Report

Former Naval Station Treasure Island, San Francisco, CA

September 2018

Approved for public release; distribution is unlimited

DCN: GLBN-0005-4239-0011

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Report

Former Naval Station Treasure Island, San Francisco, CA

September 2018

Prepared for:

Department of the Navy
Naval Facilities Engineering Command Southwest
1220 Pacific Highway
San Diego, CA 92132

Prepared by:

GILBANE FEDERAL
1655 Grant Street, Suite 1200
Concord, CA 94520

Contract Number: N62473-17-D-0005; Task Order: N6247317F4239

DCN: GLBN-0005-4239-0011

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

BAAQMD	Bay Area Air Quality Management District
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COCs	chemicals of concern
CSO	Caretaker Site Office
CTO	Contract Task Order
DCP	Dust Control Plan
EPA	United States Environmental Protection Agency
EPP	Environmental Protection Plan
Gilbane	Gilbane Federal
IR	Installation Restoration
mph	miles per hour
Navy	U.S. Department of the Navy
NIOSH	National Institute for Occupational Safety and Health
NSTI	former Naval Station Treasure Island
NTCRA	Non-Time Critical Removal Action
QC	Quality Control
Ra-226	radium-226
ROCs	radionuclides of concern
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
SWDA	solid waste disposal area

1.0 INTRODUCTION

Dust control is of concern at former Naval Station Treasure Island (NSTI) and comprises two major goals of equal importance: protection of worker safety and health, and protection of the nearby community and public at large. This Dust Control Plan (DCP) was prepared by Gilbane Federal (Gilbane), as requested by the United States Department of the Navy (Navy) under Contract No. N62473-17-D-0005, Contract Task Order (CTO) F4239.

This DCP is Attachment 2 to the Environmental Protection Plan in Appendix F of the Remedial Action/Non-Time Critical Removal Action Work Plan (Gilbane, 2018a) for this project. The Remedial Action/NTCRA Work Plan describes the field activities to be conducted and provides the framework for their implementation. The objective of this DCP is to describe and implement dust control measures and procedures that will be employed during field work activities to minimize and control fugitive dust generated by these activities, in a manner that will meet regulatory and safety requirements to protect humans and wildlife at NSTI, San Francisco, California (Figure 1).

2.0 PROJECT OVERVIEW

2.1 SITE HISTORY

Naval operations began on Treasure Island in 1941. During World War II, the Navy used NSTI for training, administration, housing, and other support services to the U.S. Pacific Fleet. In 1993 NSTI was designated for closure under the Base Realignment and Closure (BRAC) Act of 1990, and was closed on September 30, 1997.

Installation Restoration (IR) Site 12 is located on the northwest portion of NSTI (Figure 1) on a relatively flat 93-acre area. The site consists of multiplex housing units with private backyards and common area front yards, side yards, and surrounding greenbelts. Treasure Island is a man-made island adjacent to the naturally-occurring Yerba Buena Island, and was built for the 1939-1940 Golden Gate International Exposition. The area was originally used as a parking lot during the Exposition. The Navy occupied the island in 1940, and the area was subsequently developed for bunker storage of munitions and other materials, vehicle and equipment storage, recreational playing fields, and for the disposal and burning of waste. Beginning in the 1960s, areas of IR Site 12 were incrementally developed into housing for Navy personnel and their dependents. To remediate chemicals in soil associated with chemical/fuel storage and disposal or burning of waste in solid waste disposal areas (SWDAs) on the western portion of IR Site 12, a Non-Time Critical Removal Action (NTCRA) was implemented in May 2006. During the initial stages of the NTCRA, a radiation survey and sample analytical results identified debris and soil contaminated with radium-226 (Ra-226).

2.2 SCOPE OF WORK

Dust control measures will be implemented during the remedial action for soil contamination of the areas outside the SWDAs within IR Site 12 Old Bunker Area and the continuation of the IR Site 12 NTCRA at the Bayside/Northpoint SWDA at the NSTI, San Francisco, California. This DCP is Attachment 2 to the Environmental Protection Plan (EPP) as part of the RD/RAWP, and supports the abatement, control, and mitigation measures to be implemented.

Demolition, excavation, stockpiling or other dust generating activities will be temporarily halted should visible dust be released into the air. Work will be terminated during high wind conditions and any time the sustained wind speed is over 25 miles per hour (mph). Any water runoff from dust suppression activities will be minimized to the maximum extent practicable. Sandbags will be used to divert flow and prevent runoff water from discharging into adjacent storm drains. Collected runoff water will be containerized, sampled, and disposed of properly. The track-out of soil/debris from vehicles engaged in project work shall be eliminated. All trucks entering or leaving the site will be tarped.

This DCP will follow the applicable regulations described in the Bay Area Air Quality Management District (BAAQMD) Regulation 6, Particulate Matter and Visible Emissions, 6-301 Ringelman No. Limitation, 6-302 Opacity Limitation, and 6-305 Visible Particles.

Chemicals of concern (COCs) and radionuclides of concern (ROCs) shall be routinely analyzed as part of the dust control and air monitoring.

3.0 POTENTIAL SOURCES OF FUGITIVE DUST

Planned site activities have the potential to generate air emissions in the form of fugitive dust.

Possible sources of emissions include:

- Construction Traffic: Movement of heavy equipment (e.g., transportation trucks) around the work site may create construction emissions. Vehicular traffic on paved or unpaved roads and parking areas also may produce emissions.
- Site Preparation: Vegetation removal can increase the potential for fugitive dust emissions through wind erosion.
- Building Demolition: Fugitive dust may be generated during building demolition and concrete slab removal activities.
- Excavation: Removing soil from the ground and loading it either onto screening pads or into waiting vehicles could result in fugitive dust emissions.
- Material Stockpiles: Soil that has been cleared of radioactivity may be stockpiled prior to being used as backfill or shipped to appropriate disposal facilities. Soil will be loaded into trucks for final disposal. Fugitive emissions during stockpiling and truck loading, as well as wind erosion, are possible.
- Transportation of Solid Bulk Material: Soil will be transported for radiological screening and/or disposal. If soil is left uncovered, fugitive emissions could occur.
- Site Restoration: Backfilling and re-vegetation/restoration of the excavated areas may produce fugitive dust emissions.
- Recycling: Concrete may be recycled on site, which may produce fugitive dust emissions.
- Fugitive dust emissions generated upgradient of the site (offsite) also may constitute a source.

4.0 DUST CONTROL

Control methods for fugitive dust are described for the following emissions generated from the construction activities at the project site:

- Dust entrained during on-site travel on paved and unpaved surfaces.
- Dust entrained during vegetation removal, building demolition, excavation, material screening, placement of clean fill, and final grading at the removal action site.
- Dust entrained during soil stockpiling and during loading and unloading operations.
- Wind erosion of areas disturbed during removal action activities.
- Vehicle emissions associated with construction equipment.

4.1 CONSTRUCTION TRAFFIC

4.1.1 Field Traffic Control

Fugitive dust emissions from construction traffic traveling on unpaved surfaces will be controlled through the following mitigation methods:

- Actively used unpaved roads in the project construction site will be watered at a frequency sufficient to maintain adequate moisture. The frequency of watering will depend on climate conditions (precipitation, dry period, windy conditions, etc.).
- No vehicle will exceed 25 mph within the construction site and 5 mph in work areas.

The following mitigation measures will be followed for fugitive dust emissions from construction traffic traveling on paved streets:

- Bulk loaded trucks used for transportation of soil and other heavy earth-moving equipment will not be allowed to exit the construction sites, except through the track-out prevention control point, which includes a tire wash station with pressure washer when necessary.
- Construction areas adjacent to and above grade from any paved roadway will be treated with best management practices, as specified in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Stormwater Plan (Attachment 1 of the EPP).
- Roadways within the excavation site will be swept utilizing a wet sweeper or washed down to remove soils. The accumulated soils shall be routinely removed from non-traffic areas such as gutters and curbs.
- No vehicle will exceed 25 mph within the construction site and 5 mph in work areas.

If any of the preceding mitigation methods fail to properly control fugitive dust emissions, one or more of the following reasonably available control measures will be applied:

- Unpaved active portions of the construction sites will be watered more frequently to minimize windblown dust and dust generated by vehicle traffic.
- Paved portions of the construction sites will be cleaned more frequently to control windblown dust and dust generated by vehicle traffic. Water may also be applied to the paved roads if necessary.
- Gravel, recrushed/recycled asphalt, or other material of low silt content (less than five percent) will be applied to a depth of three or more inches, if necessary; material containing serpentinite will not be used for this purpose.
- Vehicle trips will be reduced if necessary.

4.1.2 Track-out Control

Rumble strips will be used to dislodge residual soil from vehicles. Soils collected by the rumble strips will be removed periodically and subsequently characterized and disposed at the direction of the Caretaker Site Office (CSO) Environmental Compliance Manager. Where necessary to prevent track-out onto public roadways, gravel pads will be constructed where trucks will be pressure-washed before exiting construction sites onto paved roads. Any visible track-out onto a paved road at any location where vehicles exit the work sites via the decontamination gravel pads and tire cleaning areas will be removed with a wet-brush street sweeper.

4.2 SITE PREPARATION AND REMEDIATION

The following mitigation measures will be followed to control fugitive dust emissions during site preparation:

- Work areas will be adequately wetted, via a handheld water dispersal device (e.g., Hudson sprayer) or tow-behind water trailer, before any vegetation removal occurs, as necessary to prevent fugitive dust emissions.
- If fugitive dust is observed by real-time aerosol monitoring equipment above the action levels established by Site Safety and Health Plan (SSHP)(Gilbane, 2017b) during site preparation, or if any visible dust is noted, activities will be halted or slowed until dust suppression is applied via a handheld water dispersal device or tow-behind water trailer. Activities may resume once detected dust levels are below the applicable action level.

4.3 BUILDING DEMOLITION ACTIVITIES

Structures will be evaluated for lead and asbestos contamination prior to start of demolition. During building demolition activities, water spraying will be used to control the spread of fugitive dust.

4.4 EXCAVATION ACTIVITIES

Fugitive dust emissions from excavation and loading activities will be controlled using the following methods:

- Soil will be wetted prior to excavation activities to reduce dust migration. Additional water will be added during active excavation, material handling, and loading on an as-needed basis. Active excavation areas will be wetted approximately every two hours or more frequently if needed, during periods of dry weather and/or windy conditions. A water truck or water buffalo shall be dedicated to excavation and removal operations.
- The height from which excavated soil is dropped either to trucks, stockpiles, or pads will be minimized.
- Trucks shall be equipped with tarping systems to cover loads during soil transport, as well as when entering or leaving the site while empty.
- Truck traffic shall be minimized to the shortest haul routes from the work areas, screening yard, and stockpile areas.
- Chemical soil stabilizer, straw mulch, or hydroseed will be applied in sufficient quantities to disturbed areas so as to create a stabilized surface.
- Backfill materials will be wetted as needed to maintain moisture. Loader buckets will be emptied slowly and drop height from the loader bucket will be minimized. A water truck or water buffalo will be dedicated to backfilling operations.
- Water or a temporary cover will be applied to control fugitive dust emissions from backfill material when not actively handled.
- If fugitive dust is observed by real-time aerosol monitoring equipment above the action levels established by the Accident Prevention Plan, Appendix A of the SSHP (Gilbane, 2017b) during excavation and loading, or if any visible dust is noted, activities will be halted or slowed until dust suppression is applied. Activities may resume once detected dust levels are below the applicable action level.

4.5 MATERIAL STOCKPILES

Fugitive dust emissions from soil storage piles will be controlled by using a temporary cover, water, or a chemical soil stabilizer.

4.6 BULK SOIL TRANSPORT

Fugitive dust emissions from trucks used to transport soil and debris will be controlled using the following methods:

- All trucks that are used to transport solid bulk material will be covered (tarped) prior to leaving the site.
- Vehicles will be checked to ensure that they are tarped and to remove any excess material on the shelf or exterior surfaces of the cargo compartment.
- Bulk-loaded trucks will exit the work site via an established track-out control point.

4.7 POST-CONSTRUCTION STABILIZATION OF DISTURBED AREAS

Unpaved areas disturbed during excavation, grading, and/or construction activities will be covered with one of the following to reduce dust generation on the site:

- An approved vegetative cover.
- Surface swales to control stormwater.
- A minimum of three inches of non-asbestos-containing material.
- Hard surface paving.

4.8 RECYCLING

Non-impacted concrete may be recycled and the process may produce fugitive dust emissions. Fugitive dust emissions from recycling activities will be controlled using the following methods:

- Concrete will be wetted prior to handling to reduce dust migration. A water truck or water buffalo shall be dedicated to this activity.
- Additional water will be added during active grinding, sorting, material handling, and loading, as needed, to minimize fugitive dust generation.
- The height from which crushed material is dropped either to trucks, stockpiles, or pads will be minimized.
- Trucks shall be equipped with tarping systems to cover loads during transport.
- Truck traffic shall be minimized to the shortest haul routes from the work areas, screening yard, and stockpile areas.
- Water, a temporary cover, or chemical soil stabilizer will be applied to stockpiles to control fugitive dust emissions.

5.0 QUALITY CONTROL PROCEDURES

A quality control (QC) program will be as followed in the Air Monitoring Plan (attachment 3 of the Environmental Protection Plan) and implemented to ensure that conditions at the monitoring stations are effective during field activities. Complete documentation of the routine operations and QC aspects of the program, including all log notes, calibration forms, and certifications, will be maintained on file located onsite at the Gilbane field office.

Dust control activities will be documented during construction activities and included in the Daily Contractor Production Reports. Results will be presented and analyzed in the Remedial Action Completion Report, which will also include all dust control field documentation and air monitoring laboratory data as appendices.

6.0 REFERENCES

Gilbane, 2017a. *Remedial Design and Remedial Action Work Plan, Installation Restoration Site 12 Remedial Action*. October.

Gilbane, 2017b. *Health and Safety Plan includes Accident Prevention Plan, Installation Restoration Site 12 Remedial Action*. October.

National Institute for Occupational Safety and Health, (NIOSH), 1994. *Manual of Analytical Methods*

United States Environmental Protection Agency (EPA), 1998. *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II: Ambient Air Specific Methods*.

FIGURES

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NAVFAC Naval Facilities Engineering Command	**IR Site 12 Non-SWDA Remedial Action/ SWDA Removal Action** Former Naval Station Treasure Island San Francisco, CA	**Figure 1** Treasure Island Location Map

G:\ArcGIS\Navy\Treasure_Island\PROJECTS\Site12_SWDA_RA\TI_Site12_Location_Map.mxd 2/7/2018 [16:01 PM] EANDERSON, Gilbane

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Naval Facilities Engineering Command Southwest
BRAC PMO West
San Diego, CA

FINAL
REMEDIAL ACTION/NON-TIME CRITICAL REMOVAL ACTION AIR MONITORING PLAN

Installation Restoration Site 12

Report, Tables and Figures

Former Naval Station Treasure Island, San Francisco, CA

September 2018

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September 2018

Prepared for:

Department of the Navy
Naval Facilities Engineering Command Southwest
1220 Pacific Highway
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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

ALI	annual limit on intake
AMP	Air Monitoring Plan
BAAQMD	San Francisco Bay Area Air Quality Management District
Cal/OSHA	California Occupational Safety and Health Administration
CFR	Code of Federal Regulations
cfm	cubic feet per minute
COCs	chemicals of concern
CTO	Contract Task Order
DAC	derived airborne concentration
dioxin	2,3,7,8-tetrachlorobenzo-p-dioxin [TCDD]
EPA	United States Environmental Protection Agency
EPP	Environmental Protection Plan
Gilbane	Gilbane Federal
IR	Installation Restoration
mg/m^3	milligrams per cubic meter
Navy	U.S. Department of the Navy
NIOSH	National Institute for Occupational Safety and Health
NSTI	Former Naval Station Treasure Island
NTCRA	Non-Time Critical Removal Action
PAH	polycyclic (polynuclear) aromatic hydrocarbon
PEL	permissible exposure limit
PCB	polychlorinated biphenyl
PM10	particulate matter less than 10 microns in diameter
QC	Quality Control
Ra-226	radium-226
RAM	real-time aerosol monitor
RAOs	remedial action objectives
RGs	Remediation goals
ROC	radionuclide of concern
SSHO	Site Safety and Health Officer
SWDAs	Solid waste disposal areas
TSP	total suspended particulates
TWA	time-weighted average
ug/m^3	micrograms per cubic meter

1.0 INTRODUCTION

Air quality is of concern at former Naval Station Treasure Island (NSTI) and monitoring will be performed to achieve two major goals of equal importance: protection of worker safety and health, and protection of the nearby community and public at large in a manner that will meet regulatory and safety requirements. This Air Monitoring Plan (AMP) is Attachment 3 to the Environmental Protection Plan in Appendix F of the Remedial Action/Non-Time Critical Removal Action Work Plan (Gilbane, 2018a) for this project and was prepared by Gilbane Federal (Gilbane), as requested by the United States Department of the Navy (Navy) under Contract No. N62473-17-D-0005, Contract Task Order (CTO) F4239. This purpose of this AMP is to describe and implement air monitoring measures during field work activities that could pose a risk to humans and wildlife at NSTI, San Francisco, California (Figure 1).

2.0 PROJECT OVERVIEW

2.1 SITE HISTORY

Naval operations began on Treasure Island in 1941. During World War II, the Navy used NSTI for training, administration, housing, and other support services to the U.S. Pacific Fleet. In 1993 NSTI was designated for closure under the Base Realignment and Closure Act of 1990, and was closed on September 30, 1997.

Installation Restoration (IR) Site 12 is located on the northwest portion of NSTI (Figure 1) on a relatively flat 93-acre area. The site consists of multiplex housing units with private backyards and common area front yards, side yards, and surrounding greenbelts. Treasure Island is a man-made island adjacent to the naturally-occurring Yerba Buena Island, and was built for the Golden Gate International Exposition, which took place in 1939-1940. The area was originally used as a parking lot during the Exposition. The Navy occupied the island in 1940, and the area was subsequently developed for bunker storage of munitions and other materials, vehicle and equipment storage, recreational playing fields, and disposal and burning of waste. Beginning in the 1960s, areas of IR Site 12 were incrementally developed into housing for Navy personnel and their dependents. To remediate chemicals in soil associated with chemical/fuel storage and disposal or burning of waste in solid waste disposal areas (SWDAs) on the western portion of IR Site 12, a Non-Time Critical Removal Action (NTCRA) was implemented in May 2006. During the initial stages of the NTCRA, a radiation survey and sample analytical results identified debris and soil contaminated with radium-226 (Ra-226).

2.2 SCOPE OF WORK

The performance objective of this project is to achieve the remedial action objectives (RAOs) of reducing risk to current and future residents by minimizing dermal contact with, incidental ingestion of, and inhalation of soil containing known chemicals of concern (COC) concentrations by excavating discrete locations with COCs above their remediation goals (RGs) and disposing of the soil offsite. This includes confirming that Ra-226 soil concentrations are below release criteria. The Air monitoring action levels are discussed in detail in Table 1.

A secondary objective of this project is to collect radiological data representative of post-remedial action or “as-left” conditions of each excavation to better inform the IR Site 12 areas outside of the SWDAs as to the presence and extent of radioactive contamination due to housing construction grading.

3.0 AIR MONITORING

Air monitoring is performed to ensure worker safety and provide reasonable assurance of the protection of the surrounding residents in accordance with National Institute for Occupational Safety and Health (NIOSH) approved air sampling methodology. Four types of air monitoring will be conducted during intrusive excavation activities:

- Real-time air quality monitoring for particulate matter less than 10 microns in diameter (PM10)
- Air quality monitoring for total suspended particulates (TSP), lead, PM10, polychlorinated biphenyls (PCBs), and polycyclic (polynuclear) aromatic hydrocarbons (PAHs), and dioxin (2,3,7,8-tetrachlorobenzo-p-dioxin [TCDD]).
- Air monitoring for radionuclides of concern (ROCs).
- Personnel monitoring.

At the discretion of the on-site air monitoring personnel, and due in part to safety concerns and equipment integrity issues, air monitoring equipment may need to be shut down and protected during precipitation events.

3.1 AIR QUALITY MONITORING

The real-time air quality monitoring for this removal action will include two downwind and one upwind perimeter dust monitoring locations at the perimeter of each excavation exclusion zone that will be monitored during earth-moving activities such as excavation and clearing. Two (2) downwind perimeter dust monitoring locations will be established and approximately 8-hour (full shift) samples should be collected using two (2) TSI Dustrak 8330 (or equivalent equipment) for total PM10 dust. The device shall be calibrated in accordance with the manufacturer's instruction. The monitoring device will continuously record aerosol concentrations corresponding to PM10 size fractions in a concentration range of 0.001 to 400 mg/m3 (i.e. 1 µg/m3 and 400,000 µg/m3). The equipment units will be programmed to trigger a visual alarm (i.e. flashing strobe light) at the 15-minute action level of 0.050 mg/m^3. If the action levels are exceeded at one or more downwind locations, upwind concentrations will be evaluated, additional dust controls will be implemented, and the Navy will notify DTSC. If the difference between upwind and downwind concentrations is greater than the action level, then cease dust generating work until dust can be controlled.

In addition to the real-time air monitoring, the air monitoring for this removal action will include portable ambient air quality monitoring stations that will be established to perform monitoring during excavation activities. Air samples will be collected at the monitoring stations and will be analyzed for the airborne contaminants of concern, including TSP, dioxin, lead, PM10, PCBs, and PAHs. The monitoring stations will be supplemented with real-time air monitoring at the perimeter for dust. The air quality sampling will be used to assess the status of air quality compliance and to evaluate modifications to project activities in the event of compliance concerns. Representative meteorological data for the general project areas, specifically wind speed and direction, will be used to identify the most appropriate locations for the air monitoring stations. Air samplers and monitoring stations will be located in the most practical locations upwind and downwind from the project site according to available wind speed and direction data.

3.1.1 Dust Action Levels

The Human and Ecological Risk Office (HERO) was asked by the California Department of Toxic Substances Control (DTSC) to develop dust action levels for community air monitoring for IR Site 12. Subchronic and chronic dust action levels as PM10 were calculated for lead, chromium, dioxin, benzo(a)pyrene (BaP), 4,4-DDD and PCBs. As presented in the document *Dust Action Levels for Installation Restoration Site 12, Former Naval Station Treasure Island, San Francisco, California* (HERO, 2018), the action levels were calculated using the maximum soil concentrations of the remaining 58 discrete excavations at IR Site 12 presented here in Table 1. The calculated action levels are summarized in Table 2.

Based on HERO's recommendations, a PM10 dust action level of the San Francisco Bay Area Air Quality Management District (BAAQMD) limit of 50 ug/m^3 will be implemented for all excavations areas at IR Site 12 except at the area surrounding sampling location KCH-1217-1. TSP is expected to be further controlled based on the limit employed for PM10, in accordance with guidance provided by BAAQMD, which estimates that PM10 makes up approximately 55 percent of TSP. If it is apparent that project activities are the cause of exceedances, additional control measures will be considered and implemented wherever practical. Air monitoring threshold criteria are listed in Table 1.

During precipitation events, the air monitoring units may not be operable. An air monitoring station or individual units being inoperable shall not preclude construction activities at the associated work site.

3.1.2 Monitoring Site Locations

A minimum of two air monitoring stations will be installed to collect air samples: one upwind and one downwind station will be monitored for the duration of the field activities. Based on past meteorological data, the prevalent wind direction at NSTI is from the west or west-southwest.

Air monitoring is performed to estimate and assess the impact of the field activities. The locations of the air monitoring stations will be selected based on the most prevalent wind direction and may be modified as needed for accessibility considerations and worker safety. Winds will be monitored daily to determine the prevailing wind direction. The downwind monitoring station will be relocated as needed. Monitoring stations will remain stationary while sampling is conducted. Radiological air monitoring will be conducted both upwind and downwind of the excavations, and in the immediate vicinity of each excavation site, in accordance with the applicable radiation work permit requirements and in the Radiological Management and Demolition Plan, which is Appendix E of the Remedial Action/NTCRA Work Plan (Gilbane, 2018a).

Each monitoring station will include four different monitoring systems: one each for TSP (which will also be analyzed for lead), PM10, PCBs alternating with PAHs, and Dioxin. Descriptions of these samplers are provided below. Sampling frequency and monitoring methods are listed in Table 2.

3.1.3 Total Suspended Particulates and Lead

TSP will be sampled with a high-volume (39 to 60 cubic feet per minute [cfm]) air sampler in accordance with the U.S. Environmental Protection Agency (EPA) reference sampling method for TSP, described in Title 40 Code of Federal Regulations (CFR), Part 50, Subpart B. Each sample will be collected on a filter over the course of a period not to exceed 24 hours; the filter then will be weighed to determine the amount of TSP collected. Once the filter weight has been determined, the sample will be analyzed for lead in accordance with one of the IO-3 methods identified in the Compendium of Methods for the Determination of Inorganic Compounds in Ambient Air (EPA, 1999). The equipment specifications and sampling procedures will comply with the specifications provided in the regulations for the sampler, filter, accuracy, calibration, and quality assurance.

The flow of the high-volume air sampler will be calibrated to establish traceability of the field measurements. Calibrations will follow the guidelines specified in 40 CFR, Part 50, Section 9.3, and Section 2.6 of the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II: Ambient Air Specific Methods (EPA, 1998).

Field logs will be used to properly record information after the samples are collected. Appropriate field data, such as date, time, sample identification, calibration data, sample location, ambient temperature and pressure, and any additional information or observations that could influence analyses of the results will be entered on the field logs.

3.1.4 PM10

PM10 will be sampled in accordance with the EPA reference sampling method for PM10, described in 40 CFR 50, Subpart J. Each sample will be collected on a filter over a period not to exceed 24 hours; the filter then will be weighed to determine the amount of PM10 collected.

3.1.5 Real-Time Dust Monitoring

Data logging real-time aerosol monitors or personal real-time aerosol monitors (RAMs) will supplement PM10 readings to provide immediate information for dust levels present at the site perimeter. A minimum of two RAMs will be used for the larger SWDA excavations. The data collected will be used to evaluate the effectiveness of dust-control procedures (in real time) and provide data during the lag time between compound-specific sampling events and laboratory analysis of the samples. The monitors will be strategically placed downwind of operations and positioned at an approximate height of 5 feet. The monitors will be checked 3 times during the work day, and stored data will be downloaded at the end of the work shift. The monitors will be calibrated and operated in accordance with the manufacturer's specifications.

Field personnel will pay special attention to the possibility of high readings generated by water vapor, insects, or other environmental factors, and thereby the chance of generating false positives. Any such observations will be logged.

3.1.6 Real-Time Petroleum Odor Monitoring

A flame ionization detector (FID) will be used to perform ambient air monitoring for organic compound emissions. Monitoring will be conducted upwind and downwind of the excavation area. The FID will be checked periodically. Exceedances of the 50 ppmv limit (SSHP; Gilbane, 2018) will require the addition of physical barriers for nuisance odor control as described in the RAWP. The FID will be calibrated and operated in accordance with the manufacturer's specifications.

3.1.7 PCBs, PAHs, and Dioxin

PCBs will be sampled and analyzed in accordance with EPA TO-4A. A high-volume (approximately 8 cfm) sampler will be used to collect PCBs on a sampling cartridge containing polyurethane foam. The same sampler will be used for collection of PAH samples and will alternate between PCB, PAH, and dioxin samples. The sampler will be operated to collect a sample for a period not to exceed 24 hours, after which the cartridge will be returned to the laboratory for analysis. PAHs will be sampled and analyzed in accordance with EPA TO-13A with results calculated as the BAP(EQ), and dioxin will be sampled in accordance with TO-9A.

3.2 AIR SAMPLING FOR RADIONUCLIDES OF CONCERN

Airborne radioactivity monitoring (continuous or grab samples) will be conducted during the course of work, in accordance with the Radiological Management and Demolition Plan (Appendix E of the Remedial Action/NTCRA Work Plan). Monitoring and trending for airborne radioactive material will be performed as necessary to control occupational exposures, establish personal protective equipment, and determine respiratory protection requirements. Each ROC has a derived airborne concentration (DAC) value. DAC is defined as the concentration of a given radionuclide in air that will result in an intake of one annual limit on intake (ALI) if breathed for a working year under working conditions (inhalation rate of 1.2 cubic meters of air per hour). (ALI is the derived limit for the quantity of radioactive material intake into the body of a worker by inhalation or ingestion in a year.)

Engineered controls will be developed in conjunction with the Radiological Affairs Support Office. They will be implemented if required to maintain airborne concentrations below 10 percent of the applicable DAC value for the ROCs at the sites. Table 3 shows the ROCs and their respective DAC values.

3.3 PERSONNEL MONITORING

The Site Safety and Health Officer (SSHO) will conduct monitoring to ensure that each site worker is adequately protected. Site monitoring and sampling includes real-time air monitoring and perimeter monitoring. In consultation with the Corporate Health and Safety Manager, the SSHO will determine if personal or addition perimeter monitoring is required to evaluate the potential for personnel exposure. Upon receipt of air quality monitoring results that exceed the Cal/OSHA PELs (PM10 – 5,000 ug/m3; TSP – 0.5 mg/m3; lead – 50 ug/m3; PCBs – 500 ug/m3; PAHs – 200 ug/m3 , as 8-hour TWAs) the SSHO will be notified and the results forwarded to the Corporate Health and Safety Manager for evaluation. Depending on the elevated results, additional sampling may be conducted for PM10, PCBs, PAHs, or lead, and personnel monitoring may be required.

3.4 QUALITY CONTROL PROCEDURES

A quality control (QC) program will be implemented to ensure that collected data are accurate and precise in order to effectively characterize both the magnitude and variations in ambient conditions at the monitoring stations. Complete documentation of the results of routine operations and QC aspects of the program, including all log notes, calibration forms, and certifications, will be maintained on file. Key elements of the routine field QC program will include:

- Routine visits to each sampling station over the sampling period to check sampler pump flow rates, verify operation and sample conditions, and note any ambient conditions that could affect the accuracy or representativeness of the sample.
- Calibration of the sampling pumps and flow devices.

- Routine preventive maintenance of all equipment components.

The analytical laboratory performing the sample analyses will establish a QC program that will ensure the accuracy of the data as the data are being analyzed. Key elements of the routine QC procedures implemented during the sample analyses will include analysis of laboratory blanks and spikes and calibration of the analytical instruments, as specified in the appropriate methodology.

An independent third party will conduct observations to document wind direction, wind speed, contractor activities and other pertinent information. Air monitoring activities will be documented during construction activities and included in the Daily Contractor Production Reports. Results will be presented and analyzed in the Remedial Action Completion Report, which will also include all air monitoring field documentation and air monitoring laboratory data as appendices.

4.0 REFERENCES

Acumen, 2018. Recommended Action Limits for Real-time PM10, Remedial Action/Non-Time Critical Removal Action. August.

Gilbane, 2018a. The Remedial Action/Non-Time Critical Removal Action Work Plan, Installation Restoration Site 12 Remedial Action. January

Gilbane, 2018b. Site Safety and Health Plan includes Accident Prevention Plan, Installation Restoration Site 12 Remedial Action. January

HERO, 2018. Dust Action Levels for Installation Restoration Site 12, Former Naval Station Treasure Island, San Francisco, California. September.

National Institute for Occupational Safety and Health, (NIOSH), 1994. Manual of Analytical Methods

United States Environmental Protection Agency (EPA), 1998. Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II: Ambient Air Specific Methods.

EPA, 1999. Compendium of Methods for the Determination of Inorganic Compounds in Ambient Air

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TABLES

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Table 1

IR Site 12 RA/NTCRA Soil Concentrations[1]

Chemical of Concern	Maximum Soil Concentration (mg/kg)
Lead	**2,600**
BAP	**10,982**[2]
Dioxin – TCDD	**0.00012**
Chromium	**452**
4,4-DDD	**2.4**
PCBs	**1000**

Notes:
[1] Soil data taken from the document *Recommended Action Limits for Real-time PM10, Remedial Action/Non-Time Critical Removal Action* (Acumen, 2018)
[2] Sample location KCH-1217-1 (Sampling and Analysis Plan, Worksheet #17 Table 17-1)

IR- Installation Restoration
NTCRA- Non-time-critical removal action
BAP- benzo(a)pyrene
TCDD - 2,3,7,8-tetrachlorobenzo-p-dioxin
mg/kg- milligrams per kilogram

Table 2

Air Monitoring Threshold Criteria

COC	Threshold Criteria ug/m^3	Basis
TSP	50	TI Site 12 Dust Action Level
PM10	50	CARB ambient air quality standards
Pb	242	TI Site 12 Dust Action Level
PCBs	N/A	TI Site 12 Dust Action Level
4,4'-DDD	200	TI Site 12 Dust Action Level
Chromium	929	TI Site 12 Dust Action Level
BAP[1]	50 (8)[2]	TI Site 12 Dust Action Level
Dioxin[1]	1E+07	TI Site 12 Dust Action Level

Notes:
[1] The dust action level was adjusted by a factor of 10 to account for the short-term duration of the project relative to the lifetime assumptions incorporated into the toxicity criteria and exposure assumptions.
[2]BAP action levels will be 50 ug/m^3 for all excavations except for at the area surrounding sampling location KCH-1217-1 at which it will be 8 ug/m^3.

CARB- California Air Resources Board
COC chemicals of concern
N/A Toxicity criteria not available
PCBs - polychlorinated biphenyls
Pb - lead
PM10 - particulate matter smaller than 10 microns in diameter
TSP - total suspended particulates
µg/m3 micrograms per cubic meter

Table 3

Sampling Frequency and Monitoring Methods

Test Scenario	Type of Analysis	Monitoring Method[1]	Frequency
Excavation and soil handling (upwind and downwind)	TSP	40 CFR, Part 50, Appendix B Analysis Method 12 (Pb)	1 sample per workday[3]
	Metals (Pb)	EPA Method 12 (modified)	1 sample per workday[3]
	PM10	40 CFR, Part 50, Appendix J	1 sample per workday[3]
	PCBs alternated by PAHs and dioxin[4]	EPA Method TO-4A EPA Method TO-13 EPA Method TO-9A	1 sample per workday[3]
	ROCs	RMDP[2]	1 sample per workday[3]
Placement of clean import fill and site restoration (upwind and downwind)	TSP	40 CFR, Part 50, Appendix B Analysis Method 12 (Pb)	1 sample per workday[3]
	Metals (Pb)	EPA Method 12 (modified)	1 sample per workday[3]
	PM10	40 CFR, Part 50, Appendix J	1 sample per workday[3]
	ROCs	RMDP[2]	1 sample per workday[3]

Notes:

1 Monitoring Method to be employed for emissions analysis or industry recognized equivalent.
2 Radiological Management and Demolition Plan (RMDP), Appendix E of the Remedial Action/NTCRA Work Plan , (Gilbane, 2018a), is a Radiation Safety Operating Procedure used for radiological air sampling activities by Gilbane.
3 Sampling may be reduced to a minimum of 2 samples per work week based on two weeks of sample results less than 50 percent of the PEL, at the discretion of the Corporate Health and Safety Manager.
4 Sampling for PCBs,PAHs, and dioxin will be alternated in this high-volume sampler.

CFR - Code of Federal Regulations
EPA - U.S. Environmental Protection Agency
PAHs - polynuclear aromatic hydrocarbons
Pb - lead
PCBs - polychlorinated biphenyls
PEL - permissible exposure limit
PM10 - particulate matter smaller than 10 microns in diameter
ROC - radionuclide of concern
TSP - total suspended particulates

Table 4

Radionuclides Airborne Concentration Guidelines

Radionuclide	Worker*	
	DAC (μCi/mL)	10% DAC (μCi/mL)
Radium-226	3.00E-10	3.00E-11

Notes:

* The guideline values were determined using the NRC's 10 CFR, Part 20, Appendix B.
μCi/mL - microcuries per milliliter (activity)
CFR - Code of Federal Regulations
DAC - derived airborne concentration
NRC - Nuclear Regulatory Commission

FIGURES

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NAVFAC Naval Facilities Engineering Command	**IR Site 12 Non-SWDA Remedial Action/ SWDA Removal Action** Former Naval Station Treasure Island San Francisco, CA	**Figure 1** Treasure Island Location Map

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APPENDIX G

WORK NOTICES

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NOTICE

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NAVSTA TI website

Asbestos Abatement, Building Demolition, and Excavation

IR Site 12: Residential Area, Former Naval Station Treasure Island

Work Will Be Performed Between
Monday, August 27, 2018 – Friday, December 28, 2018

Beginning **Monday, August 27, 2018** through **Friday, December 28, 2018,** the Navy's contractor, Gilbane, will be working in the residential area at the northern end of the Former Naval Station Treasure Island (TI).

WHY IS WORK BEING DONE?	The Navy is demolishing unoccupied buildings and excavating and disposing of contaminated soil to ensure chemical cleanup of Installation Restoration (IR) Site 12.
WHAT WILL BE DONE?	Buildings 1126 and 1217, including foundations, will be demolished and soil beneath the buildings will be excavated. Building 1127 within the Navy's controlled area will also be demolished. Demolition debris and excavated soils will be hauled offsite to a landfill. Work will be performed between 7:00 AM and 5:00 PM, Monday - Friday, excluding holidays.
WHERE WILL IT BE DONE?	See the map attached to this notice for the location of buildings to be demolished and fences to be erected around the work zones.
HOW LONG WILL IT TAKE?	Fences will be erected around buildings 1126 Reeves Court and 1217 Mariner Drive on September 5th. Work will be completed and fencing removed by December 28th.
HOW WILL IT IMPACT TENANTS?	**Most work will occur within the fence to be installed around the buildings to be demolished. There will be potential noise from equipment backup alarms and during the demolition of foundations and potential traffic during the off-haul of soil and demolition debris. Trucks hauling soil will be tarped and identified with a green numbered circle.**

For More Information

PROGRAM CONTACTS AVAILABLE FOR PROJECT-RELATED QUESTIONS OR CONCERNS:

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(415) 308-1458
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Department of Toxic Substances Control

You may visit the Navy's web site **www.bracpmo.navy.mil/nsti** to view historical and current information, including information on how to become a Restoration Advisory Board member
You may visit DTSC's web site at **www.envirostor.dtsc.ca.gov/public/.**
Enter "San Francisco"; Select "Naval Station Treasure Island";
Click "Activities" to view final documents or "Community Involvement" for public review documents

AVISO

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Eliminación de Amianto (Asbestos), Demolición de Edificios y Excavación Sitio 12 de IR: Area Residencial, Antigua Estación Naval Treasure Island

lunes, 27 de augusto de 2018 - viernes, 28 de diciembre de 2018

A partir del **lunes, 27 de augusto de 2018** hasta el **viernes 28 de diciembre de 2018**, el contratista de la Marina, Gilbane, trabajará en el zona residencial en el extremo norte de la Antigua Estación Naval Treasure Island (TI).

¿POR QUÉ SE HACE EL TRABAJO?	La Marina va a demoler edificios desocupados, excavar y desechar el suelo contaminado para asegurar la limpieza de químicas del Sitio 12 de Restauración de Instalaciones (IR).
¿QUÉ SE HARÁ?	Los edificios 1126 y 1217, incluiendo los cimientos, serán demolidos y se excavará el suelo debajo de los edificios. El edificio 1127 dentro del área controlada por la Marina también será demolido. Los desechos de la demolición y los suelos excavados serán transportados fuera del sitio a un vertedero. El trabajo se realizará entre las 7:00 a.m. y las 5:00 p.m., de lunes a viernes, excepto dias festivos.
¿DONDE SE REALIZARA EL TRABAJO?	Consulte el mapa adjunto a este aviso para conocer la ubicación de los edificios que seran demolados y zonas de trabajo que estarán encerrcados.
¿CUÁNTO TIEMPO TOMARÁ?	Cercas serán erigidas alrededor de los edificios 1126 Reeves Court y 1217 Mariner Drive el dia 5 de Septiembre. El trabajo se completará y las cercas serán removidas antes de el 28 de Diciembre.
¿CÓMO IMPACTARÁ A LOS RESIDENTES?	La mayoría del trabajo ocurrirá dentro de la zona de trabajo ubicada alrededor de los edificios que serán demolidos. Existera la potencia de aver ruidos de el equipo y durante la demolición de los cimientos y el tráfico potencial durante el transporte de tierra y escombros de demolición. Los camiones que carguen tierra serán cubiertos con una lona e identificados con un número en un círculo verde.

Para más información

CONTACTOS DEL PROGRAMA DISPONIBLES PARA PREGUNTAS O PREOCUPACIONES RELACIONADAS CON EL PROYECTO:

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Kim Walsh
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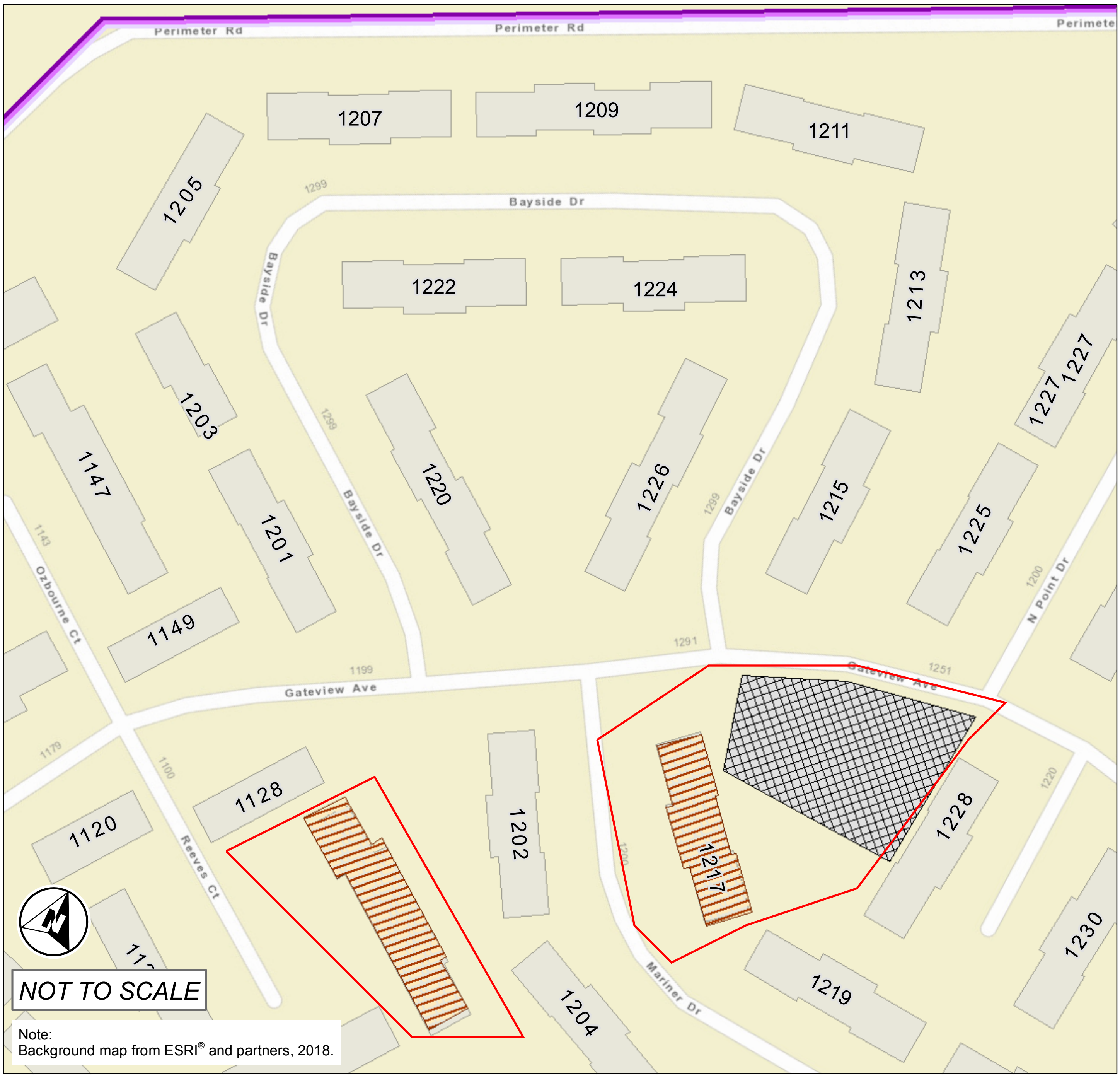
(510) 540-3773
Kim.Walsh@dtsc.ca.gov

Puede visitar el sitio web de la Marina www.bracpmo.navy.mil/nsti para ver información histórica y actual, incluida información sobre cómo convertirse en miembro de la Junta Asesora de Restauración.
Puede visitar el sitio web de DTSC en www.envirostor.dtsc.ca.gov/public/.
Ingresa "San Francisco"; Seleccione "Naval Station Treasure Island";
Haga clic en "Actividades" para ver los documentos finales o "Participación de la comunidad" para los documentos públicas.



Note:
Background map from ESRI® and partners, 2018.

G:\ArcGIS\Navy\Treasure_Island\PROJECTS\Site12_SWDA_RA\Building_Demo_Inset.mxd 8/16/2018 EANDERSON, Gilbane

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APPENDIX H

RESPONSE TO COMMENTS

Response to Document Review Comments

Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Reviewer:	**California Department of Toxic Substances Control (DTSC) Comments** from Juanita Bacey, Project Manager, Brownfields & Environmental Restoration	**Date of Comments**	06 Jun 2018

Item	Review Comment	Navy Response
1	(**DTSC General Comment #1**) The draft Work Plan uses the non-SWDA ROD cleanup goals for both the non-SWDA cleanup and the North Point SWDA NTCRA. DTSC accepts the application of the non-SWDA cleanup goals to the North Point SWDA NTCRA. However, please note that the cleanup goals in the non-SWDA ROD are based on regulatory agency guidance or site screening concentrations that are no longer current. The current screening level for total PCBs in a residential scenario is 0.23 mg/kg. See also SAP General Comment #3 below. For the forthcoming SWDA feasibility study, current screening levels should be used as cleanup goals in the SWDA areas. The most current human health screening levels are found at http://www.dtsc.ca.gov/AssessingRisk/humanrisk2.cfm <https://na01.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.dtsc.ca.gov%2FAssessingRisk%2Fhumanrisk2.cfm&data=02%7C01%7C%7C6b2344d56eeb4f6586fe08d5cafde8dd%7C3f4ffbf4c7604c2abab8c63ef4bd2439%7C0%7C0%7C636638114227413865&sdata=A0HKwoJKh8knfAFTdjEWenHZ2XcNHR4vjPGESfJ1M8E%3D&reserved=0> and https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables <https://na01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.epa.gov%2Frisk%2Fregional-screening-levels-rsls-generic-tables&data=02%7C01%7C%7C6b2344d56eeb4f6586fe08d5cafde8dd%7C3f4ffbf4c7604c2abab8c63ef4bd2439%7C0%7C0%7C636638114227423869&sdata=7WJG6N8mo5OLVlSjqS2EaMDB8WMw%2F6reXuNhPytdfWQ%3D&reserved=0> .	The Navy will perform the remaining non-SWDA remedial action per the goals set forth in the non-SWDA ROD. No changes have been made to the Work Plan. The Navy will continue to work with the DTSC to evaluate cleanup goals per the development of the SWDA/RAD Feasibility Study.
2	(**DTSC General Comment #2**) The Environmental Protection Plan indicates it will comply with various regulatory agency requirements. However, it does not include the California Air Resources Board requirements. Ambient air	The criteria for PM10 has been updated in Table 1 (now Table 2) of the Air Monitoring Plan (Attachment 3 of the Environmental Protection

Response to Document Review Comments

Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
	quality standards for PM10 must be included (https://www.arb.ca.gov/research/aaqs/pm/pm.htm). See also Appendix F Specific Comment #3 below.	Plan) to reflect California Air Resources Board requirements (50 ug/m^3 over a 24-hour TWA).
3	(**DTSC Specific Comment #1**) Section 1.2 – Schedule – Please correct the dates.	A revised schedule has been provided in Section 1.2 and Figure 5 (now Figure 6) of the SAP.
4	(**DTSC Specific Comment #2**) Section 5.6 - Site Security – Please update if buildings have been vacated.	Section 5.6 has been updated as requested.
5	(**DTSC Specific Comment #3**) Section 5.13.2.1 – Dust Control and Air Monitoring Reporting – Please add to this Section that dust action levels will be used as a criteria to take action when necessary. Due to the close proximity to residential housing, residential PM10 action levels as well as COCs in dust action levels should be developed. OSHA worker safety levels are not appropriate. See General Comment #2 above.	Paragraph 2 of Section 5.13.2.1 has been revised to add a final sentence: “Dust action levels will be used as criteria to take action when necessary.” Please see response to Item 34 (DTSC Appendix F Environmental Protection Plan Specific Comment #3) for information regarding residential dust action levels for COCs. PM10 action levels have been addressed in Item 2 above.
6	(**DTSC Specific Comment #4**) Section 5.13.2.2 Petroleum Odors – Indicates that “in the event that FID monitoring results suggest the need for additional control measures…..”, How will the FID results suggest this? What is the criteria use to make this determination? This Section must be revised and clarified.	Section 5.13.2.2 has been revised as follows: “Monitoring will be conducted upwind and downwind of the excavation area. In the event that FID monitoring results suggest the need for additional control measures as defined by the criteria presented in the EPP (Appendix F), exposed soil will be covered at the end of each workday and during periods of heavy precipitation or high winds by a 10-mil liner securely anchored by sandbags. In addition, Section 3.1.6 Real –Time Petroleum Odor Monitoring has been added to the Air Monitoring Plan (Attachment 3 of Appendix F – EPP) describing the

Response to Document Review Comments			
Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
		criteria used to determine when additional control measures are needed (i.e. 50 ppmv).
7	(**DTSC Specific Comment #5**) Section 6.1 IR Site 12 Non-SWDA Remedial Action – Indicates that "radiological screening and waste characterization of excavated soil at the RSY will occur as needed to support excavation activities." Please clarify what you mean by "as needed". Does this refer to waste characterization? Won't all excavated soil be radiologically screened?	Section 6.1, 2nd paragraph, last sentence was reworded to state; "*Radiological screening and waste characterization of excavated soil at the RSY will support excavation activities*."
8	(**DTSC Specific Comment #6**) Section 6.1.3 Pre-Excavation Soil Boring – Indicates that pre-excavation soil borings may be used as confirmation samples. Under what conditions would these boring samples be used as confirmation samples? Please clarify.	Section 6.1.5, paragraph 3, 1st sentence, was corrected to read, "*When the initial lateral extent of each excavation has been reached, confirmation samples will be collected from the sidewalls. Soil borings collected prior to excavation will serve as confirmation samples for vertical extent (see Section 6.1.3)*." Section 6.1.7, 1st paragraph, 3rd sentence was corrected to read, "*The results of the pre-excavation soil core samples (Section 6.1.3) will be used in lieu of the bottom sample*."
9	(**DTSC Specific Comment #7**) Section 6.1.7 Saturated Soil – Paragraph 1 indicates that confirmation samples will be collected. DTSC agrees that confirmation samples should be collected, however, this Section goes on to state that pre-excavation soil borings (also referred to as core boring, soil core samples) may be used in lieu of a bottom excavation confirmation samples. Please clarify under what conditions this would be done. This contradicts with Section 6.1.5, paragraph 3. Please review and clarify.	Section 6.1.5, paragraph 3, 1st sentence, was corrected to read, "*When the initial lateral extent of each excavation has been reached, confirmation samples will be collected from the sidewalls. Soil borings collected prior to excavation will serve as confirmation samples for vertical extent (see Section 6.1.3)*." Section 6.1.7, 1st paragraph, 3rd sentence was corrected to read, "*The results of the pre-excavation soil core samples (Section 6.1.3) will be used in lieu of the*

Response to Document Review Comments			
Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
		bottom sample."
10	(**DTSC Specific Comment #8**) Section 6.2.1 – Soil Excavation – Paragraph 2 – Please include the justification as to why excavation of impacted soil is limited to 4 feet bgs if visible debris is no longer observed.	As stated in Section 6.2.1, 2nd paragraph, 2nd sentence, "*The planned excavation depth is established as 4 feet bgs based on the technical specifications in the historical grading plans implemented during construction of IR Site 12 housing (Navy, 2007)*."
11	(**DTSC Specific Comment #9**) Section 6.2.2 – Saturated Soil – Paragraph 1 – Indicates that surface waters may be reused as on-site dust mitigation and that use of such will require approval by RASO prior to reuse. This contradicts with statements in the SAP that surface waters will not be sampled for radionuclides. Please clarify.	Section 6.2.2 Paragraph 2 has been revised as follows: "Surface water including rainwater collecting on RSY pads or ponding water from low spots within the project site *will be sampled for disposal in the sanitary sewer*. Water will not be reused for dust control. In addition, the SAP does not include sampling information for investigation derived waste. Details regarding the sampling of surface water for discharge to the sanitary sewer have been added to the WMP.
12	(**DTSC Specific Comment #10**) Section 6.2.2 – Saturated Soil – Paragraph 1 – Surface waters, including ponding within excavation areas, must be sampled for all COCs and approved by regulatory agencies for reuse prior to using for dust control or other uses. Please revise this section.	Please see the response to Item 11.
13	(**DTSC Specific Comment #11**) Section 6.2.3 – Confirmation Sampling and Analysis – Suggest deleting the following sentence from paragraph two because it repeats what was stated at the beginning of the paragraph: Following satisfactory results from lead, the sample will b analyzed for PCBs and PAHs.	The sentence was deleted as suggested.

Response to Document Review Comments			
Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
14	(**DTSC Specific Comment #12**) Section 6.2.3 – Confirmation Sampling and Analysis – Please include a justification for analyzing only 25% of the samples for dioxins/furans.	The project is a continuation of previous work (NTCRA Phase III WP [CB&I, 2015]), and as such the previous strategy has been adopted for the SWDA where there is only a possibility that dioxins may be detected. Detections will trigger additional sampling per Section 17.1.2 of the SAP. For those discrete excavations where dioxins are a known contaminant, the strategy is to sample at a frequency of 100%.
15	(**DTSC Appendix A SAP General Comment #1**) The approach to the soil cleanup is unclear for TPHs. TPHs are sometimes listed as COCs for soil (in text) and sometimes not (in table footnotes). TPH cleanup does seem to be an objective for soil because TPHs are included in the list of remedial goals (WS #10, Table 10-2). However, there is a footnote saying "not a COC. Cleanup goals shown…to target mass reduction in soil." The approach to deciding when sufficient TPH mass has been removed is not clear. TPHs are not included in analyte lists (WS #18) for excavation confirmation samples. Please clarify the cleanup approach for TPHs in soil. Specifically clarify decision criteria for completing TPH mass reduction. Also, please clarify the approach to TPH in the Project Objectives in the main work plan.	Section 1.1 "Project Objectives" of the Work Plan has been revised to remove TPH from the list of soil COCs. The Executive Summary of the SAP has likewise been revised to remove TPH for the list of soil COCs. Footnote 1 of Table 10-2 of SAP Worksheet 10 has been revised for clarification: "1. TPH is not a COC. Cleanup goals shown above were provided to target mass reduction in soil as applicable to the Gateview Arsenic/TPH Area for work completed in 2017 per the *Work Plan Time Critical Removal Action Installation Restoration Site 12* (CE2 Kleinfelder, 2016). The goals are presented here for use as import material criteria for Site 12."
16	(**DTSC Appendix A SAP General Comment #2**) Total chromium, 4,4-DDD, and alpha-BHC are listed as COCs in the text (WP and SAP) but tables note that these chemicals are not COCs. It appears these chemicals are being treated as COCs and will drive additional excavation in certain locations if they exceed remedial goals. Please clarify if the approach to cleanup of these chemicals in	Section 1.1 has been revised to remove total chromium and selected pesticides from the soil COC list in paragraph one, and add a second paragraph: "As stated in the Final Record of Decision/Final Remedial Action Plan for

Response to Document Review Comments

Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
	soil is the same as the other COCs listed in text and tables. Especially clarify Worksheet #11 on this point.	Installation Restoration Site 12 (Non-Solid Waste Disposal Areas and Non-Radiological) Former Naval Station Treasure Island San Francisco, California (IR Site 12 Non-SWDA/Non-Radiological ROD; Navy, 2017), the Navy will address other chemical in soil, although these chemicals were not identified as COCs in the human health or ecological risk assessments. The Navy has identified remediation goals for pesticides and chromium. The other chemicals being addressed in soil are as follows: o Total Chromium o Pesticides (4,4-dichlorodiphenyldichloroethane [4,4-DDD] and alpha-benzene hexachloride [alpha-BHC].” The executive summary of the SAP has been similarly updated. Worksheet #11, Step 5 has been revised to include chromium and selected pesticides along with the COCs both decision steps.
17	(**DTSC Appendix A SAP General Comment #3**) The SAP uses the non-SWDA ROD cleanup goals for both the non-SWDA cleanup and the North Point SWDA NTCRA. DTSC accepts the application of the non-SWDA cleanup goals to the North Point SWDA NTCRA. However, please note that the cleanup goals in the non-SWDA ROD are based on regulatory agency guidance or site screening concentrations (TI SSCs) that are no longer current. For example, the lead cleanup goal in the non-SWDA ROD is 400 mg/kg and the current DTSC residential screening level is 80 mg/kg. The slope factors and potency	The Navy will perform the remaining non-SWDA remedial action per the goals set forth in the non-SWDA ROD. No changes have been made to the Work Plan. The Navy will continue to work with the DTSC to evaluate cleanup goals per the development of the SWDA/RAD Feasibility Study.

Item	Review Comment	Navy Response
	factors for PAHs have also been updated. For the forthcoming SWDA feasibility study, please update the cleanup goals to consider the most current screening levels. The most current human health screening levels are found at http://www.dtsc.ca.gov/AssessingRisk/humanrisk2.cfm <https://na01.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.dtsc.ca.gov%2FAssessingRisk%2Fhumanrisk2.cfm&data=02%7C01%7C%7C6b2344d56eeb4f6586fe08d5cafde8dd%7C3f4ffbf4c7604c2abab8c63ef4bd2439%7C0%7C0%7C636638114227413865&sdata=A0HKwoJKh8knfAFTdjEWenHZ2XcNHR4vjPGESfJ1M8E%3D&reserved=0> and https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables <https://na01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.epa.gov%2Frisk%2Fregional-screening-levels-rsls-generic-tables&data=02%7C01%7C%7C6b2344d56eeb4f6586fe08d5cafde8dd%7C3f4ffbf4c7604c2abab8c63ef4bd2439%7C0%7C0%7C636638114227423869&sdata=7WJG6N8mo5OLVlSjqS2EaMDB8WMw%2F6reXuNhPytdfWQ%3D&reserved=0> . These current screening levels should also be considered in establishing project quantitation limits.	
18	(**DTSC Appendix A SAP Specific Comment #1**) Worksheet #5 – Project Organizational Chart, doesn't include Jerry Cooper, Gilbane's Corporate RSO/CHP. Please add Mr. Cooper since he reviews the radiological data to ensure that the DQOs have been met. He is also tasked with providing critical analysis and interpretation of radiological data.	The project organization chart has been updated to include Jerry Cooper.
19	(**DTSC Appendix A SAP Specific Comment #2**) Worksheet #10, Section 10.3 and Table 10-1 are missing information and contain irrelevant information. Table 10-1 doesn't include a summary of the previously started NTCRA that is mentioned in Worksheet #9 Action Items. Table 10-1 also doesn't include a summary of the FS Addendum that superseded the FS. Section 10.3 doesn't discuss the history of investigations and/or removals at North Point SWDA.	Worksheet 10, Table 10-1 was updated with the information for the previously started NTCRA (North Point SWDA) and the FS Addendum.

Item	Review Comment	Navy Response
	Please remove the irrelevant information and add the missing information.	
20	(**DTSC Appendix A SAP Specific Comment #3**) Worksheet #10, Section 10.4 – Nature and Extent of Contamination, doesn't describe the nature and extent except with a reference to Table 17-1. Instead it lists expected dimensions of the planned excavations. It also states "continuation of the excavation of the North Point SWDA NTCRA" but doesn't explain what has been done up to this point or what is driving continued work. Please expand Section 10.4 to include a brief narrative of the nature and extent of contamination.	Table 10-1 has been updated with a description of the previous North Point SWDA NTCRA work. In addition, a brief narrative has been added to Section 10.4 to describe what is driving the work (from the ROD/RAWP): "The contamination at Site 12 resulted from waste disposal activities by the Navy previously identified on site and from existing debris that was not removed during housing construction. The chemicals potentially released at Site 12, including metals, dioxins and furans, PCBs and PAHs, are mostly attributed to waste disposal (including burning) activities by the Navy." The remedial action detailed in this SAP and RAWP is necessary to address potential risk to current and future residential receptors from dermal contact, ingestion, and inhalation of contaminants in soil. The remedial action will also address potential risk to off-site aquatic receptors in San Francisco Bay from arsenic-contaminated groundwater. [This portion of the remedial action was completed per the TCRA (CE2Kleinfelder, 2016) in 2017.]
21	(**DTSC Appendix A SAP Specific Comment #4**) Worksheet #10, Table 10-3 states that there are no release criteria and/or screening levels for water containing Ra-226. Please revise the document to clarify the approach to disposing of (1) investigation-derived waste water that will be generated during groundwater sampling, and (2) waste water generated during	The SAP does not provide for the analysis of investigative-derived waste per BRAC policy. The requested information will be provided in the WMP.

Response to Document Review Comments

Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
	excavation and equipment decontamination. Please include the rationale for the approach.	
22	(**DTSC Appendix A SAP Specific Comment #5**) Worksheet #11 includes the goal of monitoring for Ra-226 in groundwater but there is no corresponding study question, remediation goal, screening level, or decision rule. Please clarify the purpose of the Ra-226 data for groundwater and clarify the decision rules for those data.	SAP Worksheet 11 Step 2 was revised to include the goal: "Collect radiological data representative of groundwater in the Gateview TPH/Arsenic area to support the planned Feasibility Study Addendum." The screening level is presented on WS #15.17. The decision rule was added to Step 5 : "If the concentrations of COCs exceed the project screening criteria as listed on WS #15.15 though WS #15.18, then the results will be used to delineate the extent of contamination and to support site evaluations during the preparation of the planned FS Addendum."
23	(**DTSC Appendix A SAP Specific Comment #6**) Worksheet #11 also includes a decision rule for groundwater that refers to "TPH concentrations declining and geochemical parameters are adequate for MNA". Please explain the approach to trend analysis and geochemical data interpretation that will be employed. Please specifically apply the concepts discussed in the USEPA guidance for MNA https://www.epa.gov/sites/production/files/2014-03/documents/tum_ch9.pdf <https://na01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.epa.gov%2Fsites%2Fproduction%2Ffiles%2F2014-03%2Fdocuments%2Ftum_ch9.pdf&data=02%7C01%7C%7C6b2344d56eeb4f6586fe08d5cafde8dd%7C3f4ffbf4c7604c2abab8c63ef4bd2439%7C0%7C0%7C636638114227433882&sdata=Zh3KiFdZ%2FmGSnpma6zH6BdEpEdQgHJiDcFmhnJjdpz4%3D&reserved=0> . Please expand the list of information inputs as needed to clarify the approach.	Worksheet 11 has been revised to clarify that the data will be transferred to the Basewide Groundwater Monitoring Program after collection. Step 2 Study Question is revised as follows: "Are TPH and geochemical parameter data from the Gateview Arsenic/TPH area wells (SAP WS #18) of quality suitable for supporting the basewide MNA program?" Step 5 decision rules have been revised as follows: "If the results of the dataset have been validated and are complete, then they will be transferred to the Navy for supplementing the basewide groundwater MNA dataset."

Response to Document Review Comments

Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
27	(**DTSC Appendix A SAP Specific Comment #7**) Worksheet #14, Section 14.1, mentions annual groundwater sampling but the work plan states that groundwater sampling will be done quarterly. Please clarify the groundwater monitoring frequency. Section 14.1.1 steps one and two should be reversed to prevent potential contamination of decontaminated sampling equipment. Please revise the document accordingly.	Worksheet #14, Section 14.1, has been revised to clarify that quarterly monitoring will be performed. Steps one and two of Section 14.1.1 have been reversed as requested.
28	(**DTSC Appendix A SAP Specific Comment #8**) Worksheet #15.1 lists a project quantitation limit for PAHs as BAP EQ, but this is a calculated value and as such there is no quantitation limit. Please correct the table.	The project quantitation limit goal for the BAP EQ for PAH on Worksheet #15.1 has been replaced with NA.
29	(**DTSC Appendix A SAP Specific Comment #9**) Worksheets #15.6 through #15.14 – please refer to: https://www.dtsc.ca.gov/Schools/upload/SMP_FS_Cleanfill-Schools.pdf <https://na01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.dtsc.ca.gov%2FSchools%2Fupload%2FSMP_FS_Cleanfill-Schools.pdf&data=02%7C01%7C%7Ce84160b716724a1251e908d5ca7fa849%7C3f4ffbf4c7604c2abab8c63ef4bd2439%7C0%7C0%7C636637571977008801&sdata=lKMgMKjGlJKn4nzSogfuYAU50dU9IP18Y4%2FdAzAobfQ%3D&reserved=0> to establish the approach for characterizing import fill. For example, WS #15.7 lists no project screening limits for m,p-xylenes and o-xylene but USEPA RSLs are available for these chemicals. The table also lists the out-of-date June 2017 RSL table as a reference for import fill screening limits. Further, DTSC uses more stringent screening values for certain compounds (DTSC HERO HHRA Note 3). Please update the Worksheet #15 tables with the most current version of DTSC HERO HHRA Note 3 and the RSLs as applicable. The TI SSCs established in 2005 for certain compounds are not applicable for import fill characterization. For example, the TI SSC for bromoform is listed as 62 mg/kg but the current USEPA RSL for residential soil is significantly lower at 19 mg/kg and the DTSC HERO HHRA Note 3 lists 20 mg/kg for residential	Worksheets # 15.7 through #15.14 have been updated with the current screening levels (May 2018 EPA RSLs), giving priority to DTSC HERO HHRA Note 3 values.

Response to Document Review Comments			
Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
	soil. Please use the current screening levels giving priority to DTSC HERO HHRA Note 3 values.	
30	(**DTSC Appendix A SAP Specific Comment #10**) Worksheet #18 – Please clarify whether soil samples listed will be discrete or composite samples.	An additional footnote will be added to Worksheet #18 to clarify that the samples will be discrete.
31	(**DTSC Appendix B Waste Management Plan Specific Comment #1**) Section 5.5 – Waste Inspection and Documentation Program – Indicates that formal inspections of accumulation areas will be conducted and recorded weekly. Please included that these inspections will also address any areas of concern at the time they are found.	The following was added to Section 5.5, 1st paragraph as the 2nd sentence: "*These inspections will also address any areas of concern at the time they are found*."
32	(**DTSC Appendix F Environmental Protection Plan Specific Comment #1**) Attachment 1 Storm Water Plan a. Figure 2 does not show BMPs and Figure 3 is referenced in Section 2.6 but not included. Please correct/include. b. Section 2.1.6 Project Description – Paragraph 1 does not include hot spot removals. Please add. c. Section 2.1.6 Project Description – Paragraph 7 – Refers to Building 224 slab as a slab and as a foundation. Please revise for consistency. d. Section 2.1.6 Project Description – Paragraph 10 – Does not include a bullet for hot spot excavations. Please add. e. Appendix A Construction Schedule – Schedule needs to be updated.	a. Figure 2 "Site Layout Map and BMPs" and Figure 3 "Drainage Pattern and BMPs" have been provided. b. Paragraphs 1-4 of Section 2.1.6 have been revised to include the discrete (hot spot) excavations and further update the project description. c. Section 2.1.6 has been revised to reflect that the stockpile will be at the intersection of 13th Street and Avenue M. d. Section 2.1.6 has been revised to include the discrete excavations. e. Appendix A has been updated.
33	(**DTSC Appendix F Environmental Protection Plan Specific Comment #2**) Attachment 2 - Dust Control Plan –The Plan should also indicate at what point mitigation measures will be enacted when exceedances of the action level occurs. ARB guidelines recommend, "If the action level is exceeded for a	Table 2 "Action Levels" (page 42) of the Site Safety and Health Plan (SSHP) presents at what point the mitigation measures will be enacted: "Five readings exceeding the action level in any

Response to Document Review Comments

Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
	period greater than 30 minutes, work operations will cease until adequate dust mitigation measures can be implemented." See General Comment #2 above.	15-minute period or a sustained reading exceeding the concentrations in excess of background particulate concentrations."
34	(**DTSC Appendix F Environmental Protection Plan Specific Comment #3**) Attachment 3 – Air Monitoring Plan – a. The Action levels provided in Section 3.1 and Table 1 are not appropriate for residential areas. Cal Osha worker safety actions levels are not acceptable as action levels for the community. The PM10 standard is 50 ug/m3 over a 24-hour TWA as indicated by the California Air Resources Board must be used. See the attached Memorandum from the DTSC toxicologist for an example on the development of dust action levels for contaminates in soil. b. Additionally, in regards to real-time dust monitoring as indicated in Section 3.14, two air monitoring stations may be appropriate for the small 10 ft x 10 ft excavations, but not the larger SWDA excavation. A minimum of two real-time aerosol monitors or RAMs will be required. c. Section 3.1.4 indicates the RAMs will be checked "frequently". Please specify the time frequency that they will be checked. d. Section 3.1.5 – Because COC sources are not contained to one specific area, reduction of monitoring for various COCs and/or dust is not acceptable. e. Air monitoring data shall be submitted to regulatory agencies during	a. The Air Monitoring Plan has been revised to insert a new Section 3.1.1 "Dust Action Levels" which presents calculated dust action levels for benzo(a)pyrene, selected PCBs, lead, and dioxin (2,3,7,8-TCDD) following thedocument *Draft Dust Action Levels for Installation Restoration Site 12, Former Naval Station Treasure Island, San Francisco, California* (HERO, 2018). Table 1 (now Table 2) has been updated with the California Air Resources Board PM10 standard of 50 ug/m3 over a 24-hour TWA and the site-specific calculated values. b. Section 3.1.4 (now Section 3.1.5) has been revised to insert the following after the second sentence: "A minimum of two RAMs will be used for the larger SWDA excavations." c. Section 3.1.4 (now Section 3.1.5) has been revised to specify that the RAMs will be checked 3 times per day. d. The final sentence section 3.1.5 (now Section

Response to Document Review Comments

Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
	fieldwork activities upon request.	3.1.7) has been deleted. e. Comment acknowledged.

Reviewer:	**California Department of Public Health (CDPH) Comments** from Sheetal Singh, via letter to Juanita Bacey, Project Manager, Brownfields & Environmental Restoration, Department of Toxic Substances Control (DTSC) *(This review was performed in support of the Interagency Agreement between DTSC and CDPH.)*	**Date of Comments**	Letter dated 07 Jun 2018

Item	Review Comment	Navy Response
35	(***CDPH General Comment #1***) The California Department of Public Health – Environmental Management Branch (CDPH-EMB) utilizes the California Code of Regulations (CCR), Title 17, Section 30256(k), which requires: a. Radioactive material be properly disposed; b. a reasonable effort has been made to eliminate residual radioactive contamination; c. a radiation survey has been performed which demonstrate that the premises are suitable for release for unrestricted use. In practice, this may mean employing a process similar to the one outlined in the Multi-Agency Radiation Survey and Site Investigation (MARSSIM, NRC et al, 1997), which include establishing a reference background area for each of the materials to remain in situ. These reference background measurements are then compared to survey units (SUs).	Thank you for the comment. The Navy appreciates CDPH review and input.
36	(**CDPH General Comment #2**) Please provide a figure locating Site 32.	Figure 3 was modified to show the location of Site 32.
37	(**CDPH General Comment #3**) Please provide a figure showing transportation routes for excavated soil/waste to the Radiological Screening Yards (RSYs).	A new Figure 4 was added showing the transport routes to the RSY.

Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
38	(**CDPH General Comment #4**) Will either a gamma walk over survey (GWS) or a gamma drive over survey (GDS) be performed for the transportation routes after completion of the remediation work? Please explain.	No. Treasure Island streets are public roads. State and federal DOT requirements apply. Therefore, contamination controls will be applied to trucks prior to their entry onto a public roadway. Controls will include tarping trucks and conducting a radiological survey of the tires prior to leaving the stockpile area.
39	(**CDPH General Comment #5**) Please specify soil thickness that will be used at the RSY pads and how you have determined that contamination will be detected with reasonable efficiency at the bottom of the soil on the pad.	The Radiological Management and Demolition Plan (RDMP; Appendix E), Section 6.4.2, specifies the soil thickness as 9 inches (23 cm). A technical basis document demonstrating the detection capability at this depth will be submitted to RASO for their concurrence.
40	(**CDPH General Comment #6**) Appendix E: There is little discussion (Sections 1.3 and 6.4 both simply mention that it will be performed) of radiological air sampling/monitoring despite several actions in the work plan that may disturb potentially contaminated soil. Please expand on air sampling/monitoring practices.	The Radiation Protection Plan (RPP), Section 6.2, describes radiological air sampling protocol.
41	(**CDPH General Comment #7**) Appendix E: There is no mention in this appendix of water samples to be collected or analyzed for Ra-226 as mentioned in the RAWP and Appendix A – Sampling and Analysis Plan. Please provide the appropriate information in this section.	The RDMP (Appendix E), Section 7.2.2, has been revised to state, "*Collected water is filtered or otherwise treated and sampled to verify compliance with the discharge permit prior to discharge*."
42	(**CDPH General Comment #8**) When de-posting the RCAs; what surveys will be completed to provide data demonstrating that radiological controls are no	The RPP, Section 1.3, last paragraph, was modified to include the following sentence:

Response to Document Review Comments

Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
	longer needed? Please provide explanations in the text.	"*Restricted areas may be de-posted and released from radiological controls once acceptable surface contamination levels given in Exhibit 5 are met*."
43	(**CDPH General Comment #9**) Appendix F: Please break out radiological air sampling/monitoring as its own appendix.	Radiological air sampling is addressed in the RPP, Section 6.2.
44	(**CDPH Specific Comment #10**) Section 1.1 ("Project Objectives"), Page 2, Bullet 3: Ra-226 is listed as a contaminant of concern (COC) on the same list as "Soil" and "Groundwater." Does Ra-226 apply to both soil and groundwater?	Ra-226 is a COC in both soil and groundwater.
45	(**CDPH Specific Comment #11**) Section 5.5 ("Mobilization"), Page 18, Paragraph 5, Sentence 2: Please clarify "Trucks, machinery, and equipment will be radiologically surveyed…throughout the project…" Will radiological surveys be performed on a scheduled, routine basis as well as each instance of trucks, machinery, and equipment exiting a RCA? Where will the records of these surveys be maintained? Please provide explanations in the text.	Section 5.5, 2nd sentence was modified to read as follows: "*Trucks, machinery, and equipment will be radiologically surveyed prior to initial use and decontaminated prior to first arrival, if required, and routinely throughout the project in accordance with standard operating procedures, and after completion of remedial activities. Survey records will be maintained onsite*."
46	(**CDPH Specific Comment #12**) Section 5.6 ("Site Security"), Page 19, Paragraph 1 (first full), Sentence 2: Please spell out the term represented by the acronym, "RA", and add it to the acronyms list.	In sentence 2 of paragraph 1 of Section 5.6, the acronym "RA" has been defined as Remedial Action and has been added to the acronym list.
47	(**CDPH Specific Comment #13**) Section 5.7.2 ("Temporary Construction Facilities"), Page 20, Paragraph 4, Sentence 2: "A shipping container, if needed, will be staged at IR Site 32 as a working space and for storage of tools, small equipment, and materials." Please specify storage of non-radiological materials only.	Section 5.7.2, Paragraph 4, Sentence 2 has been revised to read: "A shipping container, if needed, will be staged at IR Site 32 as a working space and for storage of tools, small equipment, and non-radiological materials."
48	(**CDPH Specific Comment #14**) Section 5.7.4 ("Equipment and Personnel Decontamination Facilities"), Page 21, Paragraph 2, Sentence 1: "Prior to constructing the pad, the area will be cleared of rocks, debris, and other	The following was added as the 2nd sentence to Section 5.7.4, 2nd paragraph: "*An initial radiological survey of the area may be performed*

Response to Document Review Comments			
Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	Date of Document:	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
	items that could puncture the liner." It would be prudent to perform an initial radiological survey of the area to ensure no radiological interference and to establish base-line data for future radiological release of the area.	*to ensure no radiological interference and to establish base-line data for future radiological release of the area*."
49	(**CDPH Specific Comment #15**) Section 5.13.2.3 ("Runoff Control"), Page 26, Paragraph 1, Sentence 2: "The RSY laydown pads and soil stockpiles will be constructed with berms to contain rainwater for collection and disposal." Will the collected rain water be analyzed for Ra-226 prior to disposal? What records of the results will be kept?	The collected water will be analyzed in conformance to the discharge permit. The RDMP (Appendix E), Section 7.2.2, states, "*Collected water is filtered or otherwise treated and sampled to verify compliance with the discharge permit prior to discharge*." Sampling results will be retained as required by the SAP (Appendix A).
50	(**CDPH Specific Comment #16**) Section 6.1 ("IR Site 12 Non-SWDA Remedial Action"), Page 28, Paragraph 3, Sentence 4: It would be prudent to place a reference in Section 6.1 to Section 5.4.5 "Foundation and Removal" of Appendix E, since that is the only mention of the foundation undersides being MARSSIM Class 1 survey units.	A reference to the RMDP (Appendix E) was added at the end of Section 6.1, 2nd paragraph.
51	(**CDPH Specific Comment #17**) Section 6.1.3 ("Pre-Excavation Soil Boring"), Page 29, Paragraph 2: Please explain and provide relevant text in the document for the following queries: a. "The analytical results [of soil core sampling] will be used to inform excavation activities…" Will the soil cores be analyzed for Ra-226? b. Will the soil cores be scanned for elevated Ra-226 activity prior to handling or shipment to an off-site laboratory?	a. Yes. See Section 1.1, 2nd paragraph that states: "*The RAOs will be achieved by excavating discrete locations of soil with COCs above the remediation goals (RGs) and disposing of the soil off-site. This includes confirming that Ra-226 soil concentrations are below the release criteria*." b. Yes. Samples will be handled in accordance with SAP Worksheet 27. A Section entitled "Sample Packaging- Radiological Samples" has

Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
		been added to Worksheet 27 of the SAP: "Samples will be delivered for analysis to the laboratory via cooler, box, or other similar container (ice is not required if only radiological analyses will be performed), along with the completed COC. Samples to be sent off site will be packaged in accordance with applicable Department of Transportation (DOT) and International Air Transport Association (IATA) procedures. At a minimum, sample containers will be placed in a box, cooler, or similar container for shipment and packaged with bubble wrap or other materials as necessary to prevent container breakage. For samples transported via commercial carrier, two custody seals will taped across the lid of the box or cooler: one seal in the front and one seal on the side. The COC will include the airbill number, and the "Received By" box will be labeled with the commercial courier's name. The COC will be sealed in a re-sealable bag and then taped to the inside of the sample cooler lid or placed inside the box. A copy of the COC will be maintained on site and a copy will be e-mailed to the Project Chemist. The box/cooler will be taped shut as necessary. The airbill will be completed for priority overnight delivery and placed in the

Response to Document Review Comments

Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
	c. Will the direct push rig (DPT) be radiologically surveyed for possible radiological contamination? d. Will DPT be decontaminated between boring locations? e. Will radiological air sampling/monitoring take place during DPT activities?	pouch, which then will be secured to the box/cooler. If multiple boxes/coolers are being shipped, the original COC will be placed in one of the boxes/cooler, and copies of the COC will be placed in the other boxes/coolers. The number of packages should be included on each airbill (e.g., 1 of 2, 2 of 2). Prepared packages will be surveyed prior to shipment." c. Yes. See Section 5.5. d. Yes. See SAP (Appendix A) Worksheet #14. e. Yes. See Section 5.13.2.
52	(**CDPH Specific Comment #18**) Section 6.1.4 ("Excavation"), Page 29, Paragraph 3, Sentence 3 a. First mention of RCA; please expand to show full form of acronym. b. "Excavated soil will be direct loaded, where possible, into a dump truck staged next to the excavation, but outside the RCA." Please explain how the spread of contamination or the loss of radiological controls will be prevented while transporting potentially contaminated loose soil over the RCA fence into a waiting truck. • Section 5.13.2.4 mentions clearing loose soil off the dove tails of the trucks. If these trucks are outside the RCA, then how will radiological controls be maintained?	a. The acronym "RCA" has been replaced with '*controlled area*'. b. The following was added to Section 6.1.4 as the 4th sentence: "*A conditional radiologically controlled area (RCA) will be established during loading activities and released once loading activities are completed*."-
53	(**CDPH Specific Comment #19**) Section 6.1.5 ("Saturated Soil"), Page 29, Paragraph 4, Sentence 4: Will temporary soil laydown/drying areas be	Yes. The RDMP (Appendix E), Section 6.1, 1st sentence, states than an RCA will be set up

Response to Document Review Comments

Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	Date of Document:	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
	radiologically investigated both prior and after use? Please explain.	around the area to be excavated. Section 6.2 states: "*A gamma scan of the area to be excavated will be performed prior to soil disturbance to identify any radiological issues that may exist or other potential worker exposure concerns*."
54	(**CDPH Specific Comment #20**) Section 6.1.7 ("Confirmation Sampling"), Page 31, Paragraph 2, Sentence 4: a. "Pre- and post-gamma static readings will be collected where practical and safe to do so." It would be prudent to perform gamma scanning of the sidewalls and floors and to take the static gamma readings at the highest location observed. b. If the excavator bucket is used to retrieve the soil sample(s); will the bucket be radiologically surveyed and decontaminated before the next sample is retrieved? Please explain.	The RMDP (Appendix E), Section 6.3, states: "*A gamma scan will be performed over 100 percent of the open excavation and additional soil samples will be collected to ensure a sampling frequency, including confirmation samples, of at least one sample every 50 m2 of excavation surface, which approximates the sampling density of a MARSSIM Class 1 survey, or about 20 samples every 1,000 square meters. These samples will be systematically distributed across the excavation surfaces and analyzed for Ra-226 only*." Yes. See SAP (Appendix A) Worksheet #14.
55	(**CDPH Specific Comment #21**) Section 6.2.1 ("Soil Excavation"), Page 33, Paragraph 2, Sentence 3: a. "Low level radioactive objects (LLROs) and Ra-226 are anticipated to be co-located with debris and excavation will continue until debris has been removed." This sentence implies that LLRO may not contain Ra-	a. The sentence has been revised as follows: "Low level radioactive objects (LLROs) containing Ra-226 are anticipated to be co-located with debris

Item	Review Comment	Navy Response
	226, please clarify. b. Page 34, Paragraph 2, Sentence 2: "Large debris may be segregated to separate staging areas within the immediate work area for further evaluation." Is the, "Immediate work area", part of the "RCA"?	and excavation will continue until debris has been removed." b. Yes. The RMDP (Appendix E), Section 6.1 states: "*Prior to initiating excavation activities, an RCA will be set up around the area to be excavated. The RCA will be sized so that work can be conducted with minimal disruption, but also to minimize the impact on residential activities in the area (e.g., street traffic, pedestrians, bus stops, etc.). The RCA will be configured based on excavator clearances, truck access, and staging areas that may be needed for material and equipment*."
56	(**CDPH Specific Comment #22**) Section 6.2.2 ("Saturated Soil"), Page 34, Paragraph 3, Sentence 5: a. "Excavations will proceed using best management procedures and only smaller areas will be opened at once time to avoid collection of large volumes of surface and ground water." Change, "at once", to, "one at a". b. Paragraph 3, last sentence: "Collected water will be contained in tanks or equivalent and processed prior to disposal." Please specify whether the collected water will be analyzed for Ra-226. Specify analytical method.	a. Sentence 5 of Paragraph 3 of Section 6.2.2 was revised as follows: "Excavations will proceed using best management procedures and only smaller areas will be opened one at a time to avoid collection of large volumes of surface and ground water." b. Collected water will be analyzed in accordance with the discharge permit. The RDMP (Appendix E), Section 7.2.2, has been revised to state, "*Collected water or is filtered or otherwise treated and sampled to verify compliance with the discharge permit prior to discharge*."

Response to Document Review Comments

Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
57	(**CDPH Specific Comment #23**) Section 6.2.2 ("Saturated Soil"), Page 35, Paragraph 1, Sentence 1: "Although not expected, water generated from dewatering activities, if collected or containerized, will be subject to the storage and treatment requirements described in the WMP (Appendix B)." Ad, "Be", between the words, "will", and, "subject."	The first sentence of paragraph 3, Section 6.2.2, was revised as follows: "Although not expected, water generated from dewatering activities, if collected or containerized, will be subject to the storage and treatment requirements described in the WMP (Appendix B)."
58	(**CDPH Specific Comment #24**) Section 6.2.5 ("Low-Level Radioactive Object Management"), Page 35 & 36: Please specify if characterization of LLRO will be performed to verify isotope. If characteristics of the LLRO are unlike Ra-226; what steps will be taken to identify the radionuclide involved?	Additional information was added to the RMDP (Appendix E), Section 7.2.1: "*A waste information fact sheet will be prepared for each RO that is recovered to detail the analytical information about the source to include photographs of the source, radionuclide identification, estimated curie content, and radiological survey information*."
59	(**CDPH Specific Comment #25**) Appendix A ("Sampling and Analysis Plan"), Worksheet #10, Page 38, first bullet: Section 6.1 "IR Site 12 non-SWDA Remedial Action" claims only 40discrete excavations where this bullet specifies 58. Please explain.	Section 6.1 of the Work Plan has been revised to specify 58 discrete excavations.
60	(**CDPH Specific Comment #26**) Appendix A ("Sampling and Analysis Plan"), Worksheet #10, Page 40, Table 10-3: Water is listed as, "Currently, there are no release criteria and/or screening levels for water." If this is the case, please explain how water from the RSYs, rain events, excavations, etc., will be screened and reused per section 6.2.2. How will water used in decontamination activities be released? Please explain when the release criteria for water will be determined.	Please see the response to Item 21.
61	(**CDPH Specific Comment #27**) Appendix A ("Sampling and Analysis Plan"), Worksheet #11, Page 41, Step 2 "Identify the Goals of the Study", bullet 3: Please specify, in text, the method that will be used to sample for Ra-226 in	Please see the response to Item 21.

Response to Document Review Comments

Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
	water.	
62	(**CDPH Specific Comment #28**) Appendix A ("Sampling and Analysis Plan"). Worksheet #11, Page 42, Step 3 "Identify Information Inputs": Please explain why gamma scanning, alpha statics, and gamma statics are not identified as information inputs.	These inputs do not involve sampling and analysis and as such are presented in the RMDP.
63	(**CDPH Specific Comment #29**) Appendix A ("Sampling and Analysis Plan"), Worksheet #14, Page 49, Section 14.1 ("Major Sampling Tasks"), bullet 3: Please add Ra-226 to the list of potential soil contaminants.	Bullet 3 in Section 14.1 has been revised as follows: "Excavate soil with PAH, Dioxin/Furan, selected pesticides, chromium, lead, and/or Ra-226 contamination above the PSLs and collect post-excavation confirmation samples."
64	(**CDPH Specific Comment #30**) Appendix A ("Sampling and Analysis Plan"), Worksheet #17, Page 83, Section 17.3 ("Import Material Sampling"), Paragraph 3, last sentence: "The imported fill material acceptance criteria for IR Site 12 are presented in Worksheets #15-6 through #15-14." Will the imported fill material analyzed for other radionuclides beside Ra-226?	The imported fill will be analyzed for a list of 17 radionuclides by EPA 901.1M. Only the Ra-226 will be screened against a PSL and be validated. The balance of the radionuclides are analyzed for informational purposes only.
65	(**CDPH Specific Comment #31**) Appendix A ("Sampling and Analysis" Plan), Worksheet #19, Page 90 & 91: EPA method 903, - "Gross alpha in drinking water	A line has been added to Worksheet #19 for alpha spectroscopy in water EPA 903.0 *Alpha-Emitting Radium Isotopes in Drinking Water"*
66	(**CDPH Specific Comment #32)** Appendix A ("Sampling and Analysis" Plan), Worksheet #22, Page 95: a. A NaI detector is listed but no SOP is provided for guidance on daily QC checks. Please list and provide a copy of the SOP that will be used in the field for daily QC checks. b. There are no instruments listed for large area gamma scanning, alpha contiguous scanning, personnel frisking, smear counting, or exposure/dose rate monitoring, and please provide this information.	a. The SOPs are provided as part of the RPP. b. The information is provided in the SOPs attached to the RPP.
67	(**CDPH Specific Comment #33**) Appendix A ("Sampling and Analysis Plan"),	Please see response to Item 51.b.

Response to Document Review Comments

Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
	Worksheet #27, Page 114, ("Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory)"): In this section there is no mention of sample coolers being screened for loose contamination nor exposure/dose rate prior to shipment to off-site laboratory, please explain and provide in text.	
68	(**CDPH Specific Comment #34**) Appendix B ("Waste Management Plan"), Page 10, Section 5.4 ("Waste Transportation and Disposal"), Paragraph 3: a. After the truck is power-washed, will the water be collected and analyzed for Ra-226? Please explain. b. First use of RCA in text please expand to show full form of acronym.	a. The RDMP (Appendix E), Section 7.2.2, has been revised to state, "*Collected water is filtered or otherwise treated and sampled to verify compliance with the discharge permit prior to discharge*." b. The acronym for RCA has been expanded to show the full form.
69	(**CDPH Specific Comment #35**) Appendix D ("Contractor Quality Control Plan"), Page 18, Section 8.3 ("DFOW 3 Site 6 and Site 32, Stockpiling of Soil and Radiologically Screening Laydown Pads"), First full paragraph: "Surveys will be conducted in accordance with Appendix A – SAP of the RD/RAWP for this CTO." Appendix A – Sampling and Analysis Plan does not mention gamma walkover surveys (GWS) / gamma scanning, please explain and provide in text.	Section 8.3, last sentence was modified to read, "*Surveys will be conducted in accordance with the Radiological Management and Demolition Plan (Appendix E) to the RAWP* for this CTO"
70	(**CDPH Specific Comment #36**) Appendix E ("Radiological Management and Demolition Plan"), Page 3, Section 1.3 ("Radiological Controls"), Paragraph 1, Sentence 2: "Trucks, machinery, and equipment will be surveyed prior to exit from a radiologically controlled area (RCA) and once released from the project to confirm they are not radioactively contaminated." It may be prudent to state that an initial survey of the trucks, machinery, and	The Work Plan, Section 5.5, 2nd sentence was modified to read as follows: "*Trucks, machinery, and equipment will be radiologically surveyed prior to initial use and decontaminated prior to first arrival, if required, and routinely throughout the project in accordance with standard operating*

Item	Review Comment	Navy Response
	equipment will be performed.	*procedures, and after completion of remedial activities.*"
71	(**CDPH Specific Comment #37**) Appendix E ("Radiological Management and Demolition Plan"), Page 3, Section 1.3 ("Radiological Controls"), Paragraph 3, Sentence 2: "Radiation protection activities will include personnel dosimetry, radiation monitoring, contamination control, and air sampling, as well as measures to maintain exposures to radiation and radioactive material as low as reasonably achievable." There is no exposure/dose rate instrumentation listed to be on site. Please explain.	The Radiation Protection Plan, Exhibit 4, lists the Ludlum Model 19 as typical survey instrumentation that may be used.
72	(**CDPH Specific Comment #38**) Appendix E ("Radiological Management and Demolition Plan"), Page 4, Section 2.1 ("Radionuclides of Concern"), Paragraph 3, Sentence 2: "Alpha particle emission is used to detect Ra-226." There are no alpha detectors listed in previous appendices or in the RAWP. Please explain.	The sentence was deleted.
73	(**CDPH Specific Comment #39**) Appendix E ("Radiological Management and Demolition Plan"), Page 8, Section 3.1.3 ("Step 3 – Inputs to the Decision"), Paragraph 2: It would be prudent to collect soil samples for analysis below the building footprint since the HRA suggests that LLRO(s) were relocated during site grading operations.	The RMDP (Appendix E), Section 6.3 describes the radiological characterization to be performed. Both gamma scans and soil sampling will be performed of the excavated building footprint.
74	(**CDPH Specific Comment #40**) Appendix E ("Radiological Management and Demolition Plan"), Page 8, Section 3.1.4 ("Step 4 – Boundaries of the Study"), Paragraph 3: "The spatial boundaries include the buildings and their footprints, and the excavation surfaces to a depth of 15 centimeters (cm)." Does this mean 15 cm below the surface or 15 cm below the terminal depth of the excavation?	Section 3.1.4, 2nd sentence was modified to read, "*The spatial boundaries include the buildings and their footprints, and excavated surfaces to a depth of 15 centimeters (cm) below the terminal depth of the excavation*."
75	(**CDPH Specific Comment #41**) Appendix E ("Radiological Management and Demolition Plan"), Page 9, Section 3.1.6 ("Step 6 – Limits on Decision Errors"), Exhibit 3-2 Decision Rules: The table under the, "else", column mentions the	The reference to concrete samples was deleted.

Response to Document Review Comments

Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
	collection of concrete samples. This is the first mention of concrete samples and the samples are not listed as a decision input. Please explain.	
76	(**CDPH Specific Comment #42**) Appendix E ("Radiological Management and Demolition Plan"), Page 9, Section 3.2 ("Field Instrumentation"), Exhibit 3-3 Survey Instrumentation: a. The first row of this table lists a Ludlum Model 43-37-1 with a window thickness of 3.4 mg/cm2. The manufacturer recommends a window thickness of 0.8 mg/cm2 for the detector used for alpha detection only. Section 2.2 "Material Specific Release", Page 5, Paragraph 2, Sentence 2, states: "Since there are no beta-emitting radionuclides of concern." b. If instrumentation is employed that collect both alpha and beta data, and if an elevated beta reading is detected; what isotopic analysis will be performed? c. Please add the above field instruments to Worksheet #22 in Appendix A – Sampling and Analysis Plan. d. It may also be prudent to add a dose/exposure rate meter and air monitoring equipment to this list. e. This list also mentions, in the first row, a Ludlum Model 2360 with a Ludlum Model 43-37-1. There is no mention of the Ludlum Model 4612 that is to be attached to the Ludlum Model 43-37-1 three by two array.	a. The first row of the table has been corrected to reflect a window thickness of 0.8 mg/cm^2. b. Gamma spectroscopy will be performed of any volumetric sample collected. c. The information is contained in the SOPs d. Instrumentation information is in Section 6.2 of the RPP. e. Exhibit 3-3 was corrected as noted.
77	(**CDPH Specific Comment #43**) Appendix E ("Radiological Management and Demolition Plan"), Page 10, Section 3.2.2 ("Instrument Response"), Paragraph 2, Sentence 1: "Instrument response checks will be conducted to assure constancy in instrument response…" Is the intent here to establish "performance checks" with on-site instrumentation rather than "response checks"?	The intent here to establish "performance checks" with on-site instrumentation. Instrument performance will be checked before the instrument is used each day. Measurements will be made using a source-geometry configuration similar to the configuration to be used for the

Response to Document Review Comments			
Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
		field measurements to be collected. For scaler instruments, an acceptable range (generally two times the standard deviation; i.e., ± 2σ around the expected value) for both source and background instrument response will be established and verified as statistically suitable using the chi-squared test. For ratemeter instruments, an acceptable range (generally ± 20 percent around the expected value) will be established.
78	(**CDPH Specific Comment #44**) Appendix E ("Radiological Management and Demolition Plan"), Page 12, Section 3.3.1 ("Methodology"): a. It would be prudent to clean the area prior to performing contiguous static measurements for alpha radiation.	As provided in Section 3.4, smear samples will be collected to detect removable alpha/beta surface radioactivity. Cleaning the surface would interfere with this measurement.
	b. Please state contiguous static count times.	The RMDP (Appendix E), Attachment 2 discusses typical detection sensitivity based on a 1-minute count time.
79	(**CDPH Specific Comment #45**) Appendix E ("Radiological Management and Demolition Plan"), Page 13, Section 3.3.2 ("Effective Survey Coverage"), Paragraph 2, Sentence 1: "…effective survey coverage of 60%, which is more than sufficient coverage for a Class 3 survey unit." While most of the building is being treated as a MARSSIM class 3 survey unit; the bottom side of the foundation is stated as being a class 1 survey unit (Section 5.4.5) for which 60^ coverage is unacceptable. Please revise this section.	A sentence was added to the end of Section 3.3.2: "*A higher survey coverage was would be needed for a Class 1 survey unit is achieved by offsetting the detector positions as described in Attachment 2.*"

Response to Document Review Comments

Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
80	(**CDPH Specific Comment #46**) Appendix E ("Radiological Management and Demolition Plan"), Page 15, Section 3.5 ("Gamma Scans"): a. "Gamma scans will be performed of the excavations and excavated soil to locate radiation anomalies…" In this section there is extensive discussion of the RS-yoo system but no mention of any other instrumentation. Is this the only instrument that will be used for gamma scanning? b. Please address excavation coverage percentage. c. Please address instrumentation MDC scan.	a. Section 3.5.1 states, "*Smaller areas that cannot be surveyed using the RS-700 system will be scanned using a hand-held Ludlum Model 44-10 2x2 NaI gamma scintillation detector with a Ludlum 2221 rate meter/scaler (or equivalent)*." b. Section 6.3 states that a gamma scan will be performed over 100 percent of the open excavation. c. As stated in Section 3.1.3, gamma scans will be used as qualitative inputs.
81	(**CDPH Specific Comment #47**) Appendix E ("Radiological Management and Demolition Plan"), Page 15, Section 3.5.1 ("Physical Configuration"), Paragraph 3: "Smaller areas that cannot be surveyed using the RS-700 system will be scanned using a handheld Ludlum Model 44-10 2x2 NaI gamma scintillation detector with a Ludlum 2221 rate meter/scaler (or equivalent)." There is no mention of this data collected from the Ludlum Model 44-10 attached to the Ludlum Model 2221 being GPS correlated. Will this data collected contain location data? Please explain and add to text.	No. Data collected with the Ludlum Model 44-10 must be assessed manually and cannot be compared or integrated with RS-700 data.
82	(**CDPH Specific Comment #48**) Appendix E ("Radiological Management and Demolition Plan"), Page 17, Section 3.5.4 ("Field Investigation"), Paragraph 2, Sentence 4: "The radioactive material will be collected, segregated, and stored in appropriate containers." Will a radiological survey be performed to verify the complete removal of radioactive material from the storage site?	The RPP, Section 1.3, last paragraph, was modified to include the following sentence: "*Restricted areas may be de-posted and released from radiological controls once acceptable surface contamination levels given in Exhibit 5 are met*."

Item	Review Comment	Navy Response
	Please specify in text.	
83	(**CDPH Specific Comment #49**) Appendix E ("Radiological Management and Demolition Plan"), Page 19, Section 3.6.5 ("Sampling and Analysis"): a. Sentence 1: "Sampling and analysis were performed in accordance with the SAP." Please change the tense "were" to "will be." b. Sentence 2: "Except where available material to sample is limited, samples collected will be approximately 1,000 grams in size." Please add the lowest weight that can be collected and a proper analysis still be performed (i.e., approximately 1000 grams, no less than…). c. It would be prudent to add sentence(s) explaining release surveys of coolers prior to shipment.	a. The sentence was corrected as noted. b. No minimum size is specified since the laboratory will attempt to analyze the sample regardless of the volume collected. c. The following was added to Section 3.6.4 as the last sentence: "*A contamination survey of the sample container will be performed prior to shipment*."
84	(**CDPH Specific Comment #50**) Appendix E ("Radiological Management and Demolition Plan"), Page 20, Section 3.7 ("Reference Areas"): Has an appropriate reference area been selected? If so please provide that information.	No reference areas have been selected at this time.
85	(**CDPH Specific Comment #51**) Appendix E ("Radiological Management and Demolition Plan"), Page 22, Section 4.1 ("Data Validation and Verification") bullet 3: Please provide acceptable QC ranges for instrumentation to be used in the field.	The RPP, Section 5.4 describes how an acceptable range for both source and background instrument response will be established.
86	(**CDPH Specific Comment #52**) Appendix E ("Radiological Management and Demolition Plan"), Page 23, Section 4.3 ("Graphical Data Review"), first sentence: "Graphical methods may include a posting plt, box-and-whisker plot, frequency plot, and/or cumulative distribution diagram constructed for each data set." Please change "plt" to "plot."	The sentence was corrected as noted.
87	(**CDPH Specific Comment #53**) Appendix E ("Radiological Management and Demolition Plan"), Page 27, Section 5.2.1 ("Survey Report"), Paragraph 4,	The sentence was corrected as noted. Section 5.0, last sentence states that the building will be

Item	Review Comment	Navy Response
	Sentence 1: "The report will be submitted to the Navy and the CDPH Radiological Health Branch for concurrence that building materials are radioactively released…" Please change "radiological released" to read "radiologically released." Will the report be reviewed and approved by RASO and CDPH Radiologic Health Branch before subject buildings are demolished?	demolished once the report has been accepted by the Navy and CDPH.
88	(**CDPH Specific Comment #54**) Appendix E ("Radiological Management and Demolition Plan"), Page 32, Section 5.4.5 ("Foundation Survey and Removal"), Sentence 2: Please elaborate on MARSSIM Class 1 and how this will differ from the rest of the building's Class 3 survey.	The following was added to Section 5.4.5 as the 4th sentence: "*The MARSSIM Class 1 classification means survey coverage will be increased to 100 percent*."
89	(**CDPH Specific Comment #55**) Appendix E ("Radiological Management and Demolition Plan"), Page 33, Section 6.1 ("Site Preparation"), Paragraph 2, Sentence 4: "Whenever possible, heavy equipment will remain outside the RCA…" Is this meant to imply that potentially radiologically contaminated soil will be removed from the RCA prior to scanning or analysis and loaded into the bed of a truck? How will the spread of potentially contaminated soil out of the RCA be prevented? (See comment 20).	The following was added to Section 6.1 as the 4th sentence: "*A conditional RCA will be established around the dump truck during loading activities and released once loading activities are completed*."
90	(**CDPH Specific Comment #56**) Appendix E ("Radiological Management and Demolition Plan"), Page 33, Section 6.2 ("Soil Excavation"), Paragraphs 3 &4: Please see previous comments regarding the inclusion of air monitoring/sampling in the text.	Radiological air sampling is addressed in the RPP, Section 6.2.
91	(**CDPH Specific Comment #57**) Appendix E ("Radiological Management and Demolition Plan"), Page 34, Section 6.4 ("Radiological Screening Yard"), Paragraph 4, Sentence 1: a. "Soil excavated during excavation activities will be transported to an RSY at Site 32 to be radiologically screened for disposal." Please provide a figure showing transport routes to Site 32. Please change "an" to "a" b. Will these transport routes be surveyed at the completion of the	a. A new Work Plan Figure 4 was added showing the transport routes to the RSY. b. No. Treasure Island streets are public roads.

Response to Document Review Comments

Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
	evolution? Please explain in text.	State and federal DOT requirements apply. Therefore, contamination controls will be applied to trucks prior to their entry onto a public roadway.
92	(**CDPH Specific Comment #58**) Appendix E (“Radiological Management and Demolition Plan”), Page 35, Section 6.4.2 (“Radiological Screening”), Paragraph 2, Final sentence: a. “A minimum of one composite sample per laydown pad will be collected and analyzed for COCs in accordance with waste disposal facility requirements.” Previously throughout the text COCs seem to refer to chemical contaminants only. Please specify that COCs refer to all contaminants (including Ra-226) or call out Ra-226. b. Section 6.4.2 (“Radiological Screening”), General: Will radiological controls be placed on RSYs during their use? Please explain in text.	a. As stated, analyses will be performed in accordance with waste disposal facility requirements. b. Section 6.4 states, “*Radiological controls, posting, maintenance, dust mitigation, air monitoring, and other measures appropriate for the RSY operation will be instituted*.”
93	(**CDPH Specific Comment #59**) Appendix E (“Radiological Management and Demolition Plan”), Page 36, Section 6.4.3 (“Stockpiling of Soil”): Will radiological controls be maintained while the soil is stockpiled? Please explain in text.	Yes. Section 6.4 states, “*Radiological controls, posting, maintenance, dust mitigation, air monitoring, and other measures appropriate for the RSY operation will be instituted*.”
94	(**CDPH Specific Comment #60**) Appendix E (“Radiological Management and Demolition Plan”), Page 39, Section 7.4 (“Transportation and Disposal”), Sentence 6: a. “The truck will then pass through a radiation portal monitor for final confirmation of successful radiological screening.” Will a radiological technician be present during portal monitor operation? b. Dose the portal monitor produce a report? c. Will a log be kept of each vehicles’ unique identifier along with the	a. Yes b. No. c. Yes.

Item	Review Comment	Navy Response
	date, time and radiological technician signature of successful radiological screening? d. What sort of tracking of trucks is used to monitor as they pass through monitors (i.e. tracking that the truck was filled and passed through the monitor)? e. Verify that the radiation portal monitor and applicable procedures are referenced in other parts of this document.	d. A simple vehicle log will be used. e. The Work Plan, Section 6.1.8 explains that work instructions may be prepared to facilitate a specific activity (such as radiation portal monitor operation) and will be provided to the Navy for review and approval.
95	(**CDPH Specific Comment #61**) Appendix E ("Radiological Management and Demolition Plan"), Page 2-6, Attachment 2 ("Technical Basis for Use of Contiguous Static Measurements in Lieu of Scanning"), Exhibit 2-3: Text appears to be missing from right side of figure. "Detector array position for". Please complete as appropriate.	The text associated with Exhibit 2-3 was corrected to properly display.
96	(**CDPH Specific Comment #62**) Appendix E ("Radiological Management and Demolition Plan"), Page 2-6, Attachment 2 ("Technical Basis for Use of Contiguous Static Measurements in Lieu of Scanning"), top of page: a. How are these results recorded to be able to distinguish the initial count and the secondary, missing coverage, count? b. First full paragraph and Small area coverage section: "Since a scan coverage of 60% is provided by the detector array itself…" This sentence reads as if to say that one static count with this detector array will cover 60% of the accessible surface. Please rephrase throughout text.	a. A value is added to the survey position measurements to indicate they were collected in the offset position. b. The measurement methodology is explained earlier as 12 individual counts – two per detector (one alpha and one beta-gamma) - are captured along with a date/time stamp for each count.
97	(**CDPH Specific Comment #63**) Appendix F ("Environmental Protection Plan"),	a. "AL1" has been updated to "ALI" throughout

Response to Document Review Comments

Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
	Page 8, Section 3.2 ("Air Sampling for Radionuclides of Concern"): a. "ALI" is written "AL1" please change throughout the document/appendix? b. Acronyms AL1 is listed as Annual limit one and should be changed to ALI-Annual Limit on Intake. c. How will air samples collected for radionuclides of concern be analyzed?	Appendix F. b. The acronym definition has been revised to Annual Limit on Intake. c. Radiological air sampling and analysis is addressed in the RPP, Section 6.2.

Reviewer:	**San Francisco Bay Regional Water Quality Board Comments** from Katrina Kaiser, Engineering Geologist	**Date of Comments**	Letter dated 8 Jun 2018

Item	Review Comment	Navy Response
98	(**RWQB General Comment – Work Plan**) The report does not provide sufficient detail explaining if/how petroleum contamination within the non-SWDAs and Northpoint SWDA will be addressed. For example, the report should describe if the excavation limits are based in any way on the defined extent of petroleum contamination (i.e., gasoline, diesel, motor oil, BTEX, or PAH constituents) in soil or groundwater, and/or if confirmatory soil or groundwater samples from the excavation limits will be analyzed for petroleum contamination. The report should also describe the response steps the Navy plans to execute to manage petroleum contamination in soil or groundwater that is encountered during the removal action.	Petroleum contamination is not a COC for this phase of the non-SWDA RA or the Northpoint SWDA NTCRA. Please see the response to Item 15. No petroleum contamination is expected to be encountered in soil or groundwater in the execution of this project.
99	(**RWQB General Comment – Waste Management Plan**) We have also reviewed the waste management plan of the Draft Remedial Action/Non-Time Critical Removal Action Work Plan, which indicates that waste water from Site 12 removal activities will be filtered or otherwise treated and sampled to verify compliance with permit and/or discharge requirements. The plan should describe specifically what permit and what discharge	As stated in the response to Item 98, petroleum is not a COC for the planned excavations, and thus no petroleum contaminated discharge is expected. The Waste Management Plan will be updated to describe the specific requirements for CERCLA contaminants per the Water Board

Response to Document Review Comments

Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
	requirements apply for the waste water discharges for CERCLA and non-CERCLA petroleum contamination. For discharges to surface water, a Water Board NPDES permit would be needed. For discharges to land, Water Board Waste Discharge Requirements may be needed.	NPDES permit.
Reviewer:	**Restoration Advisory Board (RAB) Comments** via letter addressed to Rebeca Cardoso, BRAC PMO	**Date of Comments** 8 Jun 2018
Item	**Review Comment**	**Navy Response**
100	(**RAB Comment**) A general comment is that page numbers are off on numerous documents in this Work Plan, including the plan itself, the Contractor Quality Control Plan, the Radiological Monitoring and Disposal Plan and the Environmental Plan (SWPPP).	The page number formatting in the Work Plan, Contractor Quality Control Plan, the Radiological Monitoring and Disposal Plan and the Environmental Plan (SWPPP) have been corrected.
101	(**RAB Comment**) There are two page 24 and 25 in the RD/RAWP.	Please see response to Item 101.
102	(**RAB Comment**) A number of terms are not defined in the text or in the Acronym list, including ug/g, PPW, DFOW (also called DFW) and GDA. In addition the Storm Water Pollution Prevention Plan is referred to as a SWP. Is this different from the EPA/DTSC determination for a storm water pollution prevention plan and if so, please explain the difference.	Undefined terms have been spelled out in the text at first use and defined in the acronym list. The Clean Water Act Amendments (Section 402 Phase II Rule) requires adoption of a Stormwater Pollution Prevention Plan for any construction project that affects more than 1 acre of ground. The scope of this project does not includes excavating or disturbing more than 1 acre of land. Because this work is governed under Comprehensive Environmental Response, Compensation, and Liability Act of 1980, the substantive requirements will be met; however, no permits or separate reporting are required. Consequently, a Storm Water Plan (SWP) was

Response to Document Review Comments

Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
		prepared in lieu of a Stormwater Pollution Prevention Plan.
103	(**RAB Comment**) The footers are not consistent throughout the document, some being at least 12 point. Convention has it that they be smaller than the main text.	Footers for this document have been standardized to match the font of the text, with the exception of attachments provided by subcontractors such as laboratories.
104	Superscripts are more commonly used to indicate powers.	The document has been revised throughout to indicate powers with superscripts.
105	(**RAB Comment** - **Remedial Action Work Plan**) In section 2.2 there is no mention of Pandemonium 1 on the west side of the base in the housing area. Shouldn't there be a discussion of that investigation? Also, showing the historic areas of concern on a map would be beneficial.	All historic radiological issues, including the historic activities related to Pandemonium 1, will be addressed further in the Site 12 Radiological FS.
106	(**RAB Comment** - **Remedial Action Work Plan**) Below 5.13.2.2 is a sudden random figure for biting insects. It is unclear why this would be relevant to discussions of regulatory oversight. Presumably this should be in section 3.5.3 Biting Insects. Wherever this section is relevant Lone Star ticks occur only in Texas and Oklahoma. Deer or black-legged ticks carry *Borellia*; it might be appropriate to discuss the symptoms.	As presumed, the errant page belongs in the Site Safety and Health Plan (SSHP; Gilbane, 2018), in Section 3.5.1 – Ticks. This section of the SSHP discusses the symptoms of tick-related disease.
107	(**RAB Comment** - **Remedial Action Work Plan**) Notification that playground structures will not be replaced should be included in communications to neighbors.	Thank you for the comment. The Navy will coordinate with TIDA and housing providers regarding construction impacts and site restoration.
108	(**RAB Comment** - **Remedial Action Work Plan**) A good dominant native plant to use for restoration would be *Bromus carinatus*; however, if excessive compaction is performed only weeds will grow.	Thank you for the comment. The Navy will coordinate with TIDA and housing providers regarding construction impacts and site restoration.
109	(**RAB Comment - Sampling and Analysis Plan**) The Sampling and Analysis Plan is Appendix A not B.	The executive summary of the SAP has been updated to reflect that the SAP is Appendix A of

Response to Document Review Comments

Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
		the RAWP.
110	(**RAB Comment - Environmental Protection Plan**) The site was developed as an international exposition, not a World's Fair; that was in New York at the same time. There is a disparity between the RAWP and SWPPP as to where fueling of construction equipment will take place.	The fourth sentence of paragraph one of Section 2.1.1 has been revised as follows: "TI was constructed in 1936 and 1937 for the initial purpose of hosting the Golden Gate International Exposition held in 1939-1940." In addition, the Vehicle and Equipment Fueling Section of the SWPPP (Page 25, Section 3.3.1) has been revised to match the RAWP.
111	(**RAB Comment - Site Safety and Health Plan**) The work plan does not appear to have a list of subs as stated in the SSHP and there is no indication that this will be filled in later. Are subs not expected to be used?	The Site Safety and Health Plan will be revised to state that the APP will be updated to include a list of subcontractors as they are procured (Section 5.1 of the APP).

Reviewer:	**Treasure Island Development Authority (TIDA) Comments** from Langan Engineering and Environmental Services, Inc.	**Date of Comments**	Letter dated 04 May 2018

Item	Review Comment	Navy Response
112	(**TIDA Comment #1**) General Comment 1: Please add text to the introductory material, and elsewhere (as appropriate), to clarify that the locations proposed for excavation were previously defined in the ROD and other Site 12 related reports.	Text has been added to Section 1.1 of the WP and the Executive Summary of the SAP: " The intent of this remedial action/NTCRA is to complete the work to support no further action for COCs in the IR Site 12 non-SWDAs and the North Point SWDA as described in the following documents: • IR Site 12 Non-SWDA/Non Radiological ROD (Navy, 2017) • *Action Memorandum/Interim Remedial*

Response to Document Review Comments

Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
		Action Plan: Non-Time Critical Removal Action for Solid Waste Disposal Areas, Installation Restoration Site 12, Old Bunker Area (Navy, 2007)."
113	(**TIDA Comment #2**) Section 5.7.3, Screening and Stockpiling of Soil, page 21: The first sentence of the first paragraph states that IR Site 32 will be used as a radiological screening yard (RSY); however, Figure 2 indicates that an additional RSY pad will also be placed within Site 6. Please include state in the text than an RSY pad will also be placed within Site 6. In addition, we understand that Radiological Unrestricted Release Recommendation (RURR) letters are scheduled for Site 6 and Site 32 in Spring 2018. Please clarify if the proposed work outlined in this work plan will alter the anticipated RURR schedule(s) for either site.	IR Site 6 will not be used as an RSY; however, IR Site 32 will. Figure 2 has been appropriately updated. Therefore, the RURR letter for Site 6 won't be affected by this project. However, the final status survey for Site 32 open space will occur after the fieldwork. The associated RURR and subsequent property transfer schedules will be revised accordingly.
114	(**TIDA Comment #3**) Section 5.13.2.1, Dust Control and Air Monitoring Reporting. Page 25: The last sentence of this section states that air monitoring data will be provided routinely to the Navy in a format suitable for on-line posting. Please provide additional description regarding frequency of both record keeping (e.g. daily field logs) and exceedance notifications (e.g. weekly summary reports), as applicable.	Section 5.13.2.1 will be revised to state that the air monitoring data will be presented in an air monitoring report and submitted to the Navy RPM every 2 weeks. Any exceedances will be documented in the report. Air sampling descriptions and field activities will be document in the daily field logs and submitted daily as part of the daily quality control package to the Navy.
115	(**TIDA Comment #4**) Section 6.1, IR Site 12 Non-SWDA Remedial Action, page 28: This section indicates that soil will be excavated from 40 proposed excavation locations within Site 12. As shown on Figure 2, at least six proposed excavation locations are within the footprints of existing buildings, not proposed for demolition (i.e. Buildings 1100 and 1102). Outline any additional activities and/or procedures to be followed for proposed	Table 10-1 of SAP Worksheet 10 describes the Time-Critical Removal Action for Soil at IR Site 12 during which the Navy demolished buildings 1311, 1313, 1100, 1102, 1104, and 1106. There are no excavations within the footprint of buildings not proposed for demolition.

Response to Document Review Comments

Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
	excavation locations within existing buildings. Examples of these additional activities could include resident notifications (as needed, if buildings are occupied), concrete cutting or debris removal prior to excavation, site restoration procedures (as detailed in Section 7.1) after excavation is completed.	
116	(**TIDA Comment #5**) Section 6.1, IR Site 12 Non-SWDA Remedial Action, page 28: This section reference to 40 discrete locations proposed for excavation, but the Sampling and Analysis Plan (Worksheets #10 and #17) identify 58 non-SWDA excavations. Please reconcile this discrepancy.	Section 6.1, IR Site 12 Non-SWDA Remedial Action, will be updated to identify 58 non-SWDA excavations as per the Sampling and Analysis Plan.
117	(**TIDA Comment #6**) Section 6.2, North Point SWDA Removal Action, page 33: This section states that 4,000 cubic yards of soil within SWDA North Point will be excavated. The corresponding Figure 3 just presents the boundaries of SWDA North Point. Please present the boundaries of the proposed excavation within SWDA North Point in this section and on Figure 3.	Figure 3 has been updated with the boundaries of the proposed excavation within SWDA North Point. Section 6.2 has been revised as follows: "See Figure 3 for proposed excavation boundaries."
118	(**TIDA Comment #7**) Sampling and Analysis Plan, Worksheet 17, Section 17.1.3, Radiological Confirmation Sampling: We recommend renaming this section to "Radiological Characterization" or equivalent. Renaming this section will distinguish it from confirmation sampling and analysis conducted to evaluate non-radiological COCs.	Section 17.1.3 of the SAP has been renamed "Radiological Characterization".
119	(**TIDA Comment #8**) Radiological Management and Demolition Plan, Section 3.3.1, Methodology: Please provide some additional description of the measurement process. Please explain how counts that exceed 75% of the action level will be flagged. Is the flagging an automatic process performed by software, or does it rely on the operator to review each of the 12 measurements and determine if an action level was exceeded? How is the 2 out of 3 logic implemented in practice?	The following has been incorporated into RMDP Section 3.1: "*The surveyor will manually review the results of the detector counts to flag any counts that exceed 75% of the action level. If so, a second count is collected. If any count exceeds 75% of the action level, the area is marked for investigation. If not, a third count is collected to*

Response to Document Review Comments			
Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
		confirm the first count was an anomaly."
120	(**TIDA Comment #9**) Radiological Management and Demolition Plan, Section 3.3.2, Effective Survey Coverage: Is spatial information recorded with the count data to allow for validation of the "scan" coverage and for spatial plotting (i.e. mapping) of the data? Effective coverage will depend on how well the positioning process is controlled; how will the coverage be monitored and documented?	A second paragraph was added to Section 3.3.2: "*Survey coverage will be established by a series of grid locations at which continuous static measurements will be collected. Each of the 12 individual counts collected at each location will be assigned a unique identifier relative to the detector position within the detector array. In this manner each measurement can be traced to a finite survey location*."
121	(**TIDA Comment #10**) Figures 2 and 3: RSY Pads are proposed for staging within IR Site 6 and 32. Please show the boundaries of Site 6 and 32 on Figures 2 and 3.	IR Site 6 will not be used as an RSY. Figure 3 has been modified accordingly.

Additional Follow Up Comments			
Reviewer:	**San Francisco Bay Regional Water Quality Board Comments** from Katrina Kaiser, Engineering Geologist	**Date of Comments**	Email dated 2 Aug 2018

Item	Review Comment	Navy Response
122	(**RWQB General Comment – Work Plan**) Could you clarify for me how TPH is not expected to be encountered but measures will be put into place to control petroleum odors. Does that not lend to the assumption TPH will be encountered?	As TPH is not a COC, references to soil excavation and soil screening criteria for TPH as they relate to this project have been removed from the work plan and SAP.

Response to Document Review Comments

Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Reviewer:	**California Department of Toxic Substances Control (DTSC) Comments** from Juanita Bacey, Project Manager, Brownfields & Environmental Restoration	**Date of Comments**	Email dated 2 Aug 2018

Item	Review Comment	Navy Response
123	**(DTSC Additional Comment)** Item 5 – the revision to the text is acceptable. Please also include a reference to Appendix F.	The final sentence of paragraph two of Section 5.13.2.1 has been further revised as follows: "Dust action levels are presented in the EPP (Appendix F) and will be used as criteria to take action when necessary."
124	(**DTSC Additional Comment**) Item 32 – Refers to Attachment 1 of Appendix F a – acceptable b – Attachment 1 was not provided but if the revision is made as indicated then it will be acceptable. c – Attachment 1 was not provided but if the revision is made as indicated then it will be acceptable. d – Attachment 1 was not provided but if the revision is made as indicated then it will be acceptable. e – acceptable	Comments were incorporated as indicated in Attachment 1 of Appendix F. A copy of the attachment is provided for verification.
125	(**DTSC Additional Comment**) Item 34 – Refers to Attachment 3 of Appendix F a- Section 3.1.1 – the TSP level of 0.5 mg/m^3 should be 0.05 mg/m^3 (same as the PM10 dust level). Once this revision and the calculations are revised, this will be acceptable. b - revision acceptable c - revision acceptable d - revision acceptable	a - Section 3.1.1 has been revised to incorporate the TSP level of 0.05 mg/m^3 along with the dust action levels as recommended by HERO (see Comment 34). A new paragraph was added to Section 3.1 describing real-time PM10 dust monitoring: "The real-time air quality monitoring for this removal action will include two downwind and one upwind perimeter dust monitoring locations at the perimeter of each excavation exclusion zone that will be monitored during earth-moving activities such as excavation and clearing. Two (2) downwind perimeter dust monitoring locations will be

Response to Document Review Comments			
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Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Item	Review Comment	Navy Response
		established and approximately 8-hour (full shift) samples should be collected using two (2) TSI Dustrak 8330 (or equivalent equipment) for total PM10 dust. The device shall be calibrated in accordance with the manufacturer's instruction. The monitoring device will continuously record aerosol concentrations corresponding to PM10 size fractions in a concentration range of 0.001 to 400 mg/m3 (i.e. 1 µg/m3 and 400,000 µg/m3). The equipment units will be programmed to trigger a visual alarm (i.e. flashing strobe light) at the 15-minute action level of 0.050 mg/m^3. If the action levels are exceeded at one or more downwind locations, upwind concentrations will be evaluated, additional dust controls will be implemented, and the Navy will notify DTSC. If the difference between upwind and downwind concentrations is greater than the action level, then cease dust generating work until dust can be controlled. " b, c, and d - Thank you for the comment. The Navy appreciates DTSC review and input.
126	(**DTSC Additional Comment**) In regards to Items 1 through 4, 6 through 14, 31 and 33, DTSC has no further comments.	Thank you for the comment. The Navy appreciates DTSC review and input.

Response to Document Review Comments

Document Reviewed:	***Remedial Action/Non-Time Critical Removal Action Work Plan Installation Restoration Site 12***, Treasure Island Naval Station, San Francisco, California.	**Date of Document:**	DRAFT Apr 2018
Project Site:	Installation Restoration Site 12, Former Treasure Island Naval Station, San Francisco, California		

Reviewer:	**California Department of Toxic Substances Control (DTSC) Comments** from Kim Walsh, Project Manager, Brownfields & Environmental Restoration	**Date of Comments**	Email dated 3 Aug 2018

Item	Review Comment	Navy Response
127	(**DTSC Additional Comment**) Item 15 – Please expand the proposed revision to include a TPH contingency plan in the event that staining or petroleum odors are encountered. Please remove any application of the TPH cleanup goals to import soil (for example, in Worksheet #15.11). For import soil, pleases apply the DTSC to TPH as well as other contaminants (see https://www.dtsc.ca.gov/Schools/upload/SMP_FS_Cleanfill-Schools.pdf) and revise Worksheet #15.11 accordingly.	Please see response to Item 122 – the footnote referenced in Item 15 was removed along with the TPH action levels. Worksheet #15.11 has been revised to remove the TPH cleanup goals for import soil, and apply the Information Advisory Clean Imported Fill Material guidance for TPH (i.e. RWQCB ESLs). Screening limits for other contaminants were established in accordance with the response to Item 29.
128	(**DTSC Additional Comment**) Item 17 – Response accepted. Please note that project quantitation limits that exceed final cleanup goals could require additional sampling or changes to the remedy to account for uncertainty.	Thank you for the comment. The Navy appreciates DTSC review and input.
129	(**DTSC Additional Comment**) Item 18 – Please also update Worksheet #5 with my contact information as the DTSC PM.	Worksheet #5 has been updated with the contact information for Kim Walsh as the DTSC PM.
130	(**DTSC Additional Comment**) Item 27 – Response accepted but red-line needs to be updated accordingly in Section 14.1.1.	Steps one and two of Section 14.1.1 have been updated as per the response in Item 27.
131	(**DTSC Additional Comment**) Item 28 – Please incorporate parallel revision for 2,3,7,8-TCDD TEQ on Worksheet #15.2.	The project quantitation limit goal for the 2,3,7,8-TCDD TEQ on Worksheet #15.2 has been replaced with NA.
132	(**DTSC Additional Comment**) Items 16, 19 through 26, 29 and 30 - DTSC has no further comments.	Thank you for the comment. The Navy appreciates DTSC review and input.